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SURPRISE

By

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SURPRISE

A HISTORICAL AND EXPERIMENTAL STUDY

By

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THESIS APPROVED FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE UNIVERSITY OF LONDON

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M. M. D.

March, 1939

PREFACE

THE work presented here consists of two parts. The first part is historical, the second experimental. In the first part an attempt has been made to give a historical survey of the problems involved in a study of surprise. It has been found convenient to deal with the historical material under different headings indicative of the important questions connected with surprise, the aim being to give the knowledge on the subject so far obtained rather than to trace its growth chronologically.[1] The second part comprises an experimental study of some of the problems of surprise. Both the impression and expression methods were used, the importance of introspection being emphasized in order to avoid, as far as possible, the dangers of errors in interpretation which are prone to occur in studies of emotional behaviour.

[1] A more comprehensive chronologica treatment can be seen in the writer's thesis at the University of London.

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PART I. HISTORICAL

A HISTORICAL SURVEY OF THE PROBLEMS OF SURPRISE

'WHILE some subjects in the history of psychology have been more or less adequately treated by historians, there seems to be no adequate survey of the theories of emotion.'[1] There is no text dealing with the history of theory and research of emotion.[2]

The scarcity of historical treatment, for which Brett finds a probable cause in the extraordinary indeterminateness and complexity of the subject of emotions, is even greater in relation to individual emotions. An exhaustive historical treatment of any particular emotion has not been, to the knowledge of the present writer, undertaken at all. It is, therefore, not without a feeling of diffidence that he has attempted to give, in the following pages, a historical survey of the problems involved in a study of surprise.

Surprise has been generally considered as an experience of the nature of a psychic shock.[3] But although there is general agreement as to the quality of the experience, there is considerable diversity of opinion with regard to a number of questions connected with surprise. The problems involved in a study of the emotion are dealt with below.

THE STIMULUS OF SURPRISE

As early as Aristotle references are found to the characteristics of the stimulus of surprise. Although there is no attempt at an exact classification of emotions in Aristotle[4] and surprise is not dealt with among such emotions as are treated by him,[5] yet some of his statements indicate that Aristotle regarded the unexpected and the novel as the causes of surprise.[6] The connexion of unexpectedness to

[1] Brett, G. S., *Historical Development of the Theory of Emotions*. Wittenberg Symposium, p. 388.

[2] Boring, Edwin G., *A History of Experimental Psychology*, p. 651.

[3] E.g. by Smith, Adam, *Essays. The History of Astronomy*, p. 327; Bain, A., *The Emotions and the Will* (1875), p. 83; Maher, M., *Psychology*, p. 432; Ribot, Th., *The Psychology of Emotions*, p. 369; Sully, J., *Outlines of Psychology*, p. 362; Stanley, Hiram, *The Evolutionary Psychology of Feeling*, pp. 163 sq.; Irons, David, *The Psychology of Ethics*, p. 104; Shand, A. F., *The Foundations of Character*, p. 426.

[4] Brett, G. S., *A History of Psychology*, vol. I, p. 139.

[5] In *Nicomachean Ethics* (trans. Peters) and in *Rhetorica* (trans. Rhys Roberts).

[6] *Rhetorica*, bk. III, 2, 1412*a*, and *Metaphysica* (trans. Ross), bk. I, 982*b*.

surprise was again observed by the Stoics who exhorted the wise man to ponder and thus anticipate 'all vicissitudes that fall to Man's lot' so that the wise man is 'astonished at nothing'.[1] The Sceptics regarded the novel, the unusual, the sudden and the rare as the causes of amazement,[2] while Nemesius considered 'the sudden apprehension of something' as the cause of surprise.[3] Thus before Descartes, who was the first to give a detailed treatment to surprise, there were already references to the stimulus of that emotion although there was no clear formulation and discussion of what caused surprise. One or more of the stimuli referred to above have been employed by a number of later philosophers and psychologists. According to Descartes himself, surprise is caused by the 'sudden, unexpected arrival of an impression',[4] while Malebranche considered novelty, extraordinariness and suddenness as the causes of surprise.[5] Novelty, suddenness, contrariness to expectation and unexpectedness have been mentioned, singly or in combination, by a number of subsequent authors, as the characteristics of the stimulus of surprise.

A narrow definition of the stimulus of surprise is given by Thompson when he says that it occurs in response to the 'sudden, unexpected experience of something new'.[6] Thus to cause surprise the object or situation must be, according to him, not only new but also sudden and unexpected. Bain,[7] Maher,[8] Ribot[9] and Irons[10] require the stimulus to be both novel and unexpected. Among those who believe that the stimulus must be contrary to expectation are Martineau,[11] Külpe,[12] Stanley[13] and McDougall, the last of whom asserts that 'surprise is experienced only when we suddenly apprehend a state of affairs that contradicts our anticipation or expectation'.[14] These definitions are too narrow. Those who require the stimulus

[1] Cicero, *Tusculan Disputations*, bk. III, p. 263.
[2] Sextus Empiricus, *Outlines of Pyrrhonism* (trans. Bury), vol. I, pp. 83 sq.
[3] Nemesius, *The Nature of Man* (trans. Wither), p. 392.
[4] Descartes, René, *The Philosophical Works of Descartes* (trans. Haldane and Ross), vol. I, art. LXXII, p. 363.
[5] Malebranche, *Search after Truth*, vol. I, bk. II, pp. 90 and 170; bk. III, p. 18; vol. II, bk. V, pp. 54 and 104.
[6] Thompson, Daniel, *A System of Psychology*, p. 567.
[7] Bain, A., *op. cit.* pp. 84 sq.
[8] Maher, M., *op. cit.* pp. 432 sq.
[9] Ribot, Th., *The Psychology of Attention*, p. 8.
[10] Irons, D., *op. cit.* p. 104.
[11] Martineau, J., *Types of Ethical Theory*, vol. II, pp. 151 sq.
[12] Külpe, O., *Outlines of Psychology*, p. 523.
[13] Stanley, Hiram, *op. cit.* p. 151.
[14] McDougall, Wm., *An Outline of Psychology*, p. 344.

to be novel as well as unexpected fail to take into account the large number of cases where surprise occurs even though the stimulus is 'familiar' or 'known'. Further, since every novel stimulus must be to an extent unexpected, it is a question whether it causes surprise because of its novelty or its unexpectedness. A similar question is applicable to 'suddenness', which is emphasized as the cause of surprise by Rosmini[1] and Sully.[2]

A more comprehensive definition is given by Adam Smith,[3] Thomas Brown,[4] Wundt[5] and Drever[6] who regard unexpectedness as the cause of surprise. Broader still are the definitions adopted by Darwin and McCosh. Darwin thinks that the unknown as well as the unexpected can cause surprise,[7] while for McCosh surprise is caused by 'a sudden occurrence or by one which is contrary to the natural course of things or to expectations'.[8]

Objecting to the view that surprise is the response to the unexpected Shand argues that of the events which are consciously not expected some surprise us while others, which are uniform, monotonous or regular, do not.[9] In evaluating this criticism, as in considering the value of any definition of the stimulus of surprise, it seems that the necessity of a clear conception of the term *expectation* becomes insistent, since it is a question whether uniform or regular events are to be regarded, as in some sense, 'expected' or not. But apart from the questionable validity of his criticism, Shand's view of the stimulus of surprise seems to be more satisfactory than other views. According to him the cause of surprise lies in 'some jar or conflict between a present experience and something else in the mind, be it present expectation or the effects of past experience, and to which we cannot at once adapt ourselves'.[10] The inclusion of the last limiting

[1] Rosmini, A., *Psychology*, vol. II, pp. 185 sq.

[2] Sully, James, *op. cit.* p. 362.

[3] Smith, Adam, *op. cit.* p. 325.

[4] Brown, Thomas, *Lectures on the Philosophy of the Human Mind*, p. 346.

[5] Wundt, W., *Human and Animal Psychology*, p. 376.

[6] Drever, James, *Instinct in Man*, p. 173.

[7] Darwin, Charles, *The Expression of Emotions in Animals and Man* (Popular ed. 1904), p. 296.

[8] McCosh, J., *The Emotions*, p. 136. Koffka's view may be noted here. According to him, owing to the effect of accustomed surroundings on memory in infants, the 'background' of consciousness acquires the character of a relatively fixed level upon which separate phenomena emerge. Astonishment follows whenever this level is altered (*The Growth of the Mind*, p. 241). It is unfortunate that a more elaborate treatment of the problem from the Gestalt point of view is not undertaken, not even in Koffka's later work, *The Principles of Gestalt Psychology*.

[9] Shand, *Foundations*, p. 419.

[10] *Ibid.* p. 420.

clause is, however, open to question. For it can be argued that a jar or conflict cannot occur unless there is a momentary failure of adaptation so that the limiting clause is superfluous. If, however, Shand means that it is necessary for the lack of adaptation to be prolonged beyond the initial moment of jar or conflict, then it might be objected that such limitation is not borne out by facts, the initial jar or conflict being sufficient to cause surprise in many cases in which adaptation takes place 'at once'.

An interesting theory of the causation of surprise, apparently opposed to the theories advanced by others, has been postulated by Reik. According to him, surprise occurs when there is a fulfilment of a repressed expectation.[1] 'Surprise will be the greatest', he says, 'when there is involved confirmation or fulfilment of expectations which have been repressed.'[2]

If Reik believes that in the genesis of all surprise the fulfilment of an unconscious expectation is involved, then obviously his belief implies an erroneous generalization based on the interpretation of the experiences of surprise observed by him in analytical situations. He would then fail to account for the innumerable cases of surprise where there is no indication of the existence of unconscious expectations, much less would he be able to explain those cases where there is an absence even of the knowledge of the stimuli.

Even with regard to the analytic situation, it is highly questionable if Reik is justified in speaking of the fulfilment of an unconscious expectation. Is he not rather confusing knowledge, desire, wish or hope with expectation? Perhaps it may be argued that the unconscious cannot distinguish between these states and expectation, that for it to desire or to wish is to expect. Even so Reik fails to consider the possibility of a dual attitude in relation to an event which fulfils an unconscious wish, desire or hope and yet causes surprise. If it is probable that an unconscious 'expectation' is based on, or is identical with, a wish, desire or hope of the occurrence of an event, it is equally probable that another expectation also exists, opposed to the first one, and based on past experience and on the fear or anxiety regarding the non-occurrence of that event. If an event towards which there is a dual attitude of this nature causes surprise, it is not improbable that the surprise is due to the conflict of the event with those components of the attitude according to which the

[1] Reik, Theodor, *Surprise and the Psycho-Analyst*, p. 52.

[2] 'New ways in psycho-analytic technique', *Int. J. Psycho-anal.* vol. XIV, p. 323, 1933.

event was unexpected.[1] Further, granting that an unconscious expectation exists, Reik ignores the time and place components of an expectation when he regards an expectation as fulfilled even though the supposedly expected 'fact comes upon us at an unexpected time or under unexpected circumstances'.[2]

Reik has regarded surprise as a defence-reaction, as the 'expression of our struggle against any call upon us to acknowledge something long known to us which has become unconscious'.[3] This is a valuable observation on the employment of surprise as a defence-mechanism, but it cannot be invoked as a proof that in all surprise a confirmation of unconscious knowledge or fulfilment of an unconscious expectation is involved. Such confirmation or fulfilment cannot be considered as the original stimulus of surprise. Emotions are frequently employed as defence-mechanisms, unconsciously or non-consciously, and sometimes even consciously, as when they are simulated. One may simulate aversion towards a person one really loves. But this does not mean that in its genesis aversion is aroused by an object which possesses characteristics which evoke love. Aversion has to be *simulated* because the object *does not* possess the characteristics which would naturally arouse that reaction. It possesses rather the characteristics which would evoke a reaction of the opposite type. Similarly in the case of surprise, the fact that it is used as a defence-mechanism indicates that the event in relation to which surprise is simulated does not possess the characteristics which would by their very nature arouse that reaction. The analysand adopts surprise as a device to convince the analyst as well as his own super-ego that he could not have harboured the thoughts which he is accused of harbouring. The device is adopted because it is unconsciously assumed that other human beings and the super-ego itself are aware that surprise cannot

[1] Surprise can occur in relation to events towards which there are similar dual attitudes even when none of the attitudes is repressed. Consider for instance the surprise of a man who wins a sweepstake.

[2] Reik, *Surprise and the Psycho-Analyst*, p. 52. It might be pointed out that even when an 'expectation' is merely non-conscious (and not unconscious or repressed) surprise frequently occurs if the time or place component is indefinite. It is interesting to note here that some of Philp's subjects who were engaged in a conative task and expected to hear a buzzer which was meant as a signal, reported surprise as 'the first feeling on hearing the buzzer'. Philp explains this by saying that 'the time was not so long as had been expected or else concentration was so great that the expectation of the buzzer was not present in consciousness' (Philp, Howard L., 'An experimental study of the frustration of will-acts and conation', *Brit. J. Psychol. Monogr. Suppl.* No. 21, p. 68, 1936).

[3] Reik, *New ways in psycho-analytic technique*, pp. 332 sq. and *Surprise and the Psycho-Analyst*, p. 52.

be experienced in relation to an event which is known or expected.

The fulfilment of an unconscious expectation cannot, therefore, be considered as the stimulus of surprise.

But Reik's work rightly emphasizes the efficacy of one's own thoughts and activities in causing surprise.[1] Indeed, as has been observed, he thinks that the most marked surprises occur in relation to ideas which confirm or fulfil unconscious expectations. Sydney Smith held a view opposed to that of Reik for he thought that concepts were less efficacious in causing surprise than percepts.[2] Patterson, who follows Shand in making a division of surprises into 'Sensational' and 'Cognitive'[3]—or according to Patterson's own terminology 'Predominantly Sensory' and 'Predominantly Ideational'—thinks that stimuli which cause the former type of surprise are more efficacious than those which arouse the latter variety.[4] In the absence of comparable data a conclusion as to this issue is not justified.

The inhibitory tendency of surprise

From early times some observations have been made, with varying degrees of clarity, on the tendency of surprise to inhibit motor reactions.[5]

Since Descartes onwards there have been explicit and definite references to the association of surprise with a state of immobility. Descartes observed that a high degree of surprise causes 'the whole body to remain as immobile as a statue'.[6] Malebranche also observed that in surprise 'the body continues in the same posture as if it were immovable'.[7] Similar observations are made by some later psycho-

[1] The efficacy of ideas in causing surprise has been recognized from early times. Aristotle thought that 'nothing would surprise a geometer so much as if the diagonal turned out to be commensurable' (*Metaphysica*, bk. I, 982*b*), Plotinus refers to the 'salutary astonishment' of one who 'beholds the solitary principle of the universe' (*An Essay on the Beautiful*, pp. 31 sq.), and St Augustine expressed great surprise at the power of memory (*Confessions*, bk. X, p. 248). Mrs Shinn's observation of the surprise induced in a baby by her own vocal efforts may be noted in this connexion (*Notes on the Development of a Child*, p. 86).

[2] Smith, Sydney, *Elementary Sketches of Moral Philosophy*, pp. 373 sq.

[3] Shand, *Foundations*, p. 423.

[4] Patterson, Emily, 'A qualitative and quantitative study of the emotion of surprise', *Psychol. Rev. Monogr.* vol. XL, p. 105, 1930.

[5] Diogenes, *Ancient Philosophers*, p. 531; Cicero, *Tusculan Disputations*, bk. IV, pp. 347 sq.; Hicks, R., *Stoics and Epicureans*, p. 266; Lucretius, *De Rerum Natura* (trans. Rouse), p. 153; Nemesius, *The Nature of Man* (trans. Wither), p. 386; Aquinas, Thomas, *Summa Theologia*, vol. VI, pp. 483 sq.

[6] Descartes, *op. cit.* art. LXXIII, pp. 363 sq.

[7] Malebranche, *op. cit.* vol. II, p. 55.

logists.[1] Shand says that in surprise there is a motionless attitude, and action is suspended.[2] Surprise causes an arrest not merely of the motor activities but also of the thought processes in which the individual experiencing surprise is engaged before that experience.[3] It does not seem improbable that this inhibitory tendency of surprise extends to all mental processes whatever including emotional reactions.

Some experimental investigations lend support to the observations regarding the inhibitory effect of surprise on motor activities. In her investigation of conscious attitudes in which blind-point alphabet was used for tactual perception, Helen Clarke found that some subjects reported 'inhibition of movement' in connexion with surprise.[4] Grassi, in her study of reaction-times under conditions of concentrated and diffused attention, found that the longest reaction-times were recorded when surprise was reported.[5] The experiments of Morgan[6] and Evans,[7] in connexion with distractions, also point to a delay in performance, and a similar indication was found in the experiments of Wilcocks in connexion with the effect of unexpected heterogeneity on attention.[8] In these investigations the lengthening of reaction-times and the delay in performance may be attributed to the inhibitory tendency of surprise.

[1] E.g. by Bain, *op. cit.* pp. 215 sq.; Wundt, *Outlines of Psychology*, pp. 198 sq.; Lewes, *Problems of Life and Mind*, pp. 298 sq. Preyer, referring to astonishment in infants, says 'the whole body (is) motionless, the arms retaining exactly the same position as before the impression was made, while there is a silence that would be called "speechlessness" if the infant were capable of speech' (*Mental Development in the Child*, p. 23). Mosso regards 'a sudden, unexpected agitation' as necessary to induce the paralysing effect of fright (Mosso, Angelo, *Fear*, p. 242).

[2] Shand, *Foundations*, p. 426.

[3] Cf. Lindsay, W. L., *Mind in the Lower Animals*, vol. II, p. 241; Stern, W., *The Psychology of Early Childhood*, p. 74; Külpe, *op. cit.* p. 324; Irons, D., *op. cit.* p. 104.

[4] Clarke, Helen M., 'Conscious attitudes', *Amer. J. Psychol.* vol. XXII, p. 225, 1911.

[5] Grassi, Isabella, 'Einfache Reaktionszeit und Einstellung der Aufmerksamkeit', *Z. Psychol.* vol. LX, pp. 46–72, 1911, from Pillsbury, W. B., 'Attention and interest', *Psychol. Bull.* vol. IX, 1912.

[6] Morgan, John J., 'The overcoming of distraction and other resistances', *Arch. Psychol.* No. 35, pp. 35, 65 and 83, 1916.

[7] Evans, John E., 'The effect of distraction on reaction-time', *Arch. Psychol.* No. 35, p. 53, 1916.

[8] Wilcocks, R. W., 'The effect of unexpected heterogeneity on attention', *J. gen. Psychol.* vol. I, 1928. Although the author does not note it, it is interesting to observe that the only subject in whom surprise was marked enough to be reported, returned a reaction-time which was longer than those of all other subjects.

Surprise and attention

Another fact connected with surprise which has been observed by a number of psychologists is the association of that emotion with attention. Aristotle observed that the closest attention is paid 'when subjects of deliberation are alarming'.[1] Descartes, giving a physiological description of the process of attention following surprise, says that surprise 'causes the animal spirits to leave the cavities of the brain and take their way...to the place where is the impression of the object'.[2] Thomas Brown thought that surprise leads to fixation of attention on the surprising object.[3] A similar opinion is held by Bain.[4] Some authors have even confused the emotion with a species of attention. According to Darwin sudden and close attention 'graduates into surprise'.[5] Ribot, who deals with surprise in greater detail in his book on attention than in his work on the emotions, goes so far as to say that surprise is only 'spontaneous attention augmented'.[6] Titchener regarded surprise as 'merely attention to an idea that is suddenly presented and that differs from the ideas forming the consciousness of the moment'.[7] At another place he states that a sudden stimulus, which he regards as surprising, attracts attention.[8] Such a stimulus, he says, becomes clear in its own right.[9]

Rutgers Marshall takes the view that there are certain 'co-ordinations of activities tending to effectiveness of attention' and surprise arises in connexion with these.[10] 'We should expect', he says, 'to find marked in consciousness the instinct feelings corresponding to those instinctive activities that determine effective attention with its accompaniment of clear perception; for these instinct-actions are forceful and immediate in reaction. I think we are able to recognize these instinct feelings in consciousness in the complex state known as the emotion of surprise.'[11]

The views of some of the authors cited above imply that surprise

[1] Aristotle, *De Rhetorica ad Alexandrum* (trans. Foster), ch. 28, 1436*b*.

[2] Descartes, *op. cit.* art. LXXIII, pp. 363 sq.

[3] Brown, Thomas, *op. cit.* p. 348.

[4] Bain, A., *op. cit.* (1st ed.) pp. 215 sq.

[5] Darwin, Charles, *The Expression of Emotions*, p. 293. Darwin also refers to the orientation of attention towards startling objects (*ibid.* p. 316).

[6] Ribot, Th., *The Psychology of Attention*, p. 29.

[7] Titchener, E. B., *A Primer of Psychology*, p. 153.

[8] *A Text-Book of Psychology*, part I, p. 269.

[9] *The Psychology of Feeling and Attention*, pp. 195 sq.

[10] Marshall, H. Rutgers, *Pain, Pleasure and Aesthetics*, p. 77.

[11] *Instinct and Reason*, p. 120.

does not precede attention but comes with it or after it. Rignano objects to such a view. He asserts that the affective tendencies are the foundations of the motor elements in attention and that the reverse is false.[1] To support his contention he refers to surprise, pointing out that in relation to a surprising noise attention is awakened before and not after the adjustment of the organ concerned in observing the source of the noise.[2]

Shand states the relationship of surprise to attention by saying that 'the effect of surprise is to make us attend to the event that surprises us',[3] and further that 'surprise survives with diminishing intensity in the act of attention that follows it'.[4]

It is a question whether the tendency to immobility in surprise noticed above is not merely an aspect of the tendency of surprise to pay attention to the object that evokes the emotion.

Duration and feeling-tone

It is generally recognized that surprise has a short duration.[5] But there is no unanimity of opinion as to the question of the feeling-tone of surprise.

Some have regarded surprise as pleasurable. Hume believed surprise to be a 'pleasure arising from novelty'.[6] Sydney Smith thought that surprise, in itself, is slightly agreeable.[7]

Maher, Groos, Stern and Allen seem to regard surprise as unpleasurable in itself but think that there are neutralizing agents. The neutralizing effect is derived for Maher from the 'pleasure springing from a fresh energy',[8] and for Allen from the stimulus to activity involved in surprise which excites and vivifies the mind.[9] For Groos

[1] Rignano, Eugenio, 'Attention', *Monist*, vol. XII, p. 16, 1912.

[2] *Ibid.* p. 18.

[3] Shand, *Foundations*, p. 430.

[4] *Ibid.* Some indirect experimental evidence in support of the view that surprise is associated with attention is available in the works of Angell, J. R., and Thomson, H., 'A study of the relation between certain organic processes and consciousness', *Psychol. Rev.* vol. VI, p. 62, 1899; Lehmann, A., *Die körperlichen Äusserungen psychischer Zustände.* pp. 67–103, 1899, and Wilcocks, *op. cit.* p. 272.

[5] Cf. Smith, Adam, *op. cit.* p. 327; Maher, *op. cit.* pp. 432 sq.; Ribot, *The Psychology of Attention*, p. 31 and *The Psychology of Emotions*, p. 369; Sully, *The Human Mind*, vol. II, pp. 125 sq.; Stout, *Analytic Psychology*, vol. II, pp. 275 sq.; McDougall, *Social Psychology*, pp. 157 sq.; Drever, *Instinct in Man*, p. 174; Shand, *Foundations*, pp. 426, 430 and 445.

[6] Hume, David, *A Treatise on Human Nature*, vol. I, p. 97.

[7] Smith, Sydney, *op. cit.* p. 375.

[8] Maher, *op. cit.* p. 433.

[9] Allen, *Pleasure and Instinct*, pp. 112 sq.

surprise is not unpleasurable because it possesses 'the charm of strong stimuli'.[1] According to Stern surprise becomes pleasurable when, after the first check, the possibility of a continuous reaction to the stimulus is established.[2]

Külpe,[3] Stanley[4] and Patterson[5] think that the feeling-tone of surprise is unpleasant.

The views noticed above seem to have been based on the observations of a restricted kind in which surprise probably occurred in close association with pleasurable or unpleasurable experiences. In Patterson's experiments, for instance, the stimuli were such that surprise was likely to be frequently associated with fear.

Some psychologists believe that surprise is capable of being either pleasurable or unpleasurable or that it is neutral in its feeling-tone. Bain,[6] Lewes,[7] Daniel Thompson[8] and Feldman[9] are of this opinion. This view seems to be based on the observation of surprise in association with pleasurable as well as unpleasurable experiences.[10]

Stout points out the difficulty of separating the feeling-tone of surprise from that of the experience with which surprise blends. But he rather uncritically affirms that when the circumstance causing surprise is indifferent, the feeling-tone of surprise depends on whether the curiosity following surprise is satisfied or not.[11] He thus confuses the feeling-tone of surprise with that of curiosity.

It seems that those who regard the feeling-tone of surprise as either pleasurable or unpleasurable are confusing the feeling-tone of surprise with that of the experiences which blend with it or follow it, while

[1] Groos, Karl, *The Play of Man*, p. 163.

[2] Stern, W., *Psychology of Early Childhood*, p. 136.

[3] Külpe, O., *op. cit.* pp. 324 sq.

[4] Stanley, Hiram, *The Evolutionary Psychology of Feeling*, pp. 51 sq.

[5] Patterson, Emily, *op. cit.* p. 103.

[6] Bain, A., *op. cit.* 3rd ed. p. 85. In the second edition of his work Bain had regarded surprise as only a name for 'painful disappointment' (p. 85), which view he appears to have revised in the later edition.

[7] Lewes, *Problems of Life and Mind*, p. 385.

[8] Thompson, D., *op. cit.* p. 567.

[9] Feldman, R. V., 'The metaphysics of wonder and surprise', *Philosophy*, vol. IX, p. 212, 1934.

[10] It is interesting to note here that in an investigation of the affective life of nine subjects carried out by Flügel the introspective reports show that surprise was one of the two affective states (the other being excitement) which figured among the pleasurable as well as the unpleasurable states (Flügel, J. C., 'A quantitative study of feeling and emotion in everyday life', *Brit. J. Psychol.* vol. XV, pp. 345 sq., 1925, Tables VI and VII). In the experiments of G. B. Phelan also, surprise and astonishment were frequently reported in connexion with both pleasure and unpleasure (*Feeling Experience and its Modalities*).

[11] Stout, G. F., *Analytic Psychology*, vol. II, pp. 275 sq.

those who regard it as neutral are basing their belief on the inference that since surprise is found associated with experiences possessing both types of feeling-tone, its own feeling-tone must be neutral. The validity of such an inference is highly questionable since no way has been devised to ascertain the feeling-tone of surprise as such and the possibility that the feeling-tone of surprise may be counteracted or enhanced by its association with experiences of a pleasurable or unpleasurable nature has not been eliminated. For the present, therefore, Shand's view regarding the question of the feeling-tone of surprise, that it is one 'to which no certain answer can be given'[1] appears to be the most acceptable. On theoretical grounds, however, one may believe that the feeling-tone of surprise is slightly unpleasurable owing to the state of momentary lack of adaptation implied in the experience. If this view is accepted, then it may be said that in those cases where surprise appears to be pleasurable the unpleasure is swamped by the pleasure of the experience which blends with or immediately follows surprise.

Is surprise an emotion?

The question whether surprise is to be regarded as an emotion or not has raised a considerable amount of controversy.

Descartes considered surprise as an independent emotion in its own right, and together with wonder he placed it at the head of the passions.[2] Malebranche, who confused surprise with admiration and wonder, called admiration the first of all passions although an imperfect one, since 'it is neither excited by the idea nor the sensation of good'.[3] Hume expressly designated surprise as a passion.[4]

According to Adam Smith, however, surprise is not an emotion at all. For him 'the violent and sudden change produced upon the mind, when an emotion of any kind is brought suddenly upon it, constitutes the whole nature of surprise'.[5] Brown, objecting to this view, pointed out that surprise is 'not merely a rapid change of feelings but a new feeling'.[6] Bain,[7] Wundt,[8] Marshall,[9] Ribot[10] and others[11] have treated surprise as an emotion. Stout affirms that in

[1] Shand, *Foundations*, p. 435.
[2] *Op. cit.* vol. I, art. LXIX, p. 362.
[3] Malebranche, *op. cit.* vol. II, p. 54.
[4] Hume, David, *op. cit.* vol. I, pp. 76 sq.
[5] Smith, Adam, *op. cit.* p. 327.
[6] Brown, Thomas, *op. cit.* pp. 347 sq.
[7] Bain, A., *op. cit.* pp. 215 sq.
[8] Wundt, W., *Outlines of Psychology*, pp. 198 sq.
[9] Marshall, H. Rutgers, *Instinct and Reason*, p. 120.
[10] Ribot, Th., *The Psychology of Attention*, p. 31.
[11] Cf. the inclusion of surprise among different classifications of emotions (*infra*).

its rudimentary form surprise is absolutely primary. It does not presuppose other emotional experiences as its conditions or components.[1]

The view that surprise is not an emotion has been followed by Sydney Smith[2] and Irons[3] and has been particularly emphasized and elaborated by McDougall and Shand. McDougall asserts that surprise is not 'a true and primary emotion'.[4] Indeed, he excludes surprise from his list 'whether of simple and primary or complex emotions'.[5] Surprise is not a true and primary emotion because it is 'an affective state that implies no corresponding instinct and has no specific conative tendency. It is merely a condition of general excitement which is produced by an impression which is contrary to anticipation.... It is the momentary state of confused excitement which intervenes between the reception of the impression and the assumption of the appropriate attitude towards it, a moment of conflict and confusion between the habitual anticipatory attitude determined by the course of previous experience and the new attitude provoked by the unusual course of events.'[6] McDougall further says that surprise presupposes some more or less definite anticipation of the course of events. It is experienced only when this anticipation is contradicted. 'Now the anticipation or expectation implies... the working of some impulse, some desire or aversion, that prompts us to anticipate. Surprise is therefore dependent upon, or derived from, the anticipating desire; it is therefore a derived emotion.'[7]

Thus, although McDougall admits the emotional nature of surprise, he refuses to regard it as a primary emotion.

It seems that McDougall's view is based on a too restricted definition of emotion and conation in general and on a narrow definition of the conditions under which surprise occurs.[8]

[1] Stout, G. F., *The Groundwork of Psychology*, p. 196.

[2] Smith, Sydney, *op. cit.* vol. I, p. 367.

[3] Irons, D., *op. cit.* p. 104. Irons's objection to consider surprise as an emotion is without adequate basis since surprise conforms to his definition of an emotion (p. 73) and possesses as much claim to be called an emotion as some of the experiences regarded as emotions by Irons (p. 106).

[4] McDougall, Wm., *An Introduction to Social Psychology*, p. 157.

[5] *Ibid.* p. 48. [6] *Ibid.* pp. 157 sq.

[7] McDougall, Wm., *An Outline of Psychology*, p. 344.

[8] It may be pointed out that some of the 'primary' emotions mentioned by McDougall do not conform to the qualifications required by him. Anger, for instance, is not aroused by any specific object or objects, as admitted by McDougall himself (*Social Psychology*, p. 59). The reason for regarding surprise as a derived emotion—that it implies the operation of some impulse—applies to anger as well, the condition of its excitement being 'any opposition to the free exercise of any impulse' (*ibid.*).

Shand's view is similar to McDougall's. He thinks that the uniqueness of feeling and the considerable intensity possessed by surprise constitutes it an original emotion in a sense,[1] but since the one impulse which 'we are inclined...to attribute to it—that involved in understanding the surprising event itself—belongs to either curiosity or wonder' surprise lacks an impulse and cannot be regarded as an emotional system. 'It has neither impulse nor end. It is a temporary state of disorganisation.'[2] Again, Shand says that although surprise is an emotion in the ordinary use of the term and, as an emotion capable of great intensity, it is classed with emotions like fear and anger, yet 'in another respect, it is quite unique and exceptional. Unlike all other primary emotions it cannot assimilate or reject ideas, nor rise from a stage of blind and instinctive impulse to foresight of an end, nor increase the complexity of its system by organizing a greater number of both instinctive and acquired tendencies; for as a momentary state of disorganization it is the opposite of all we mean by system.'[3] He concludes that if the foregoing facts are considered in its connotation, then 'surprise will no longer be classed among the emotions'.[4]

Unlike McDougall and Shand, Drever thinks that there is 'no sufficient ground to deny the emotional nature of surprise'.[5] He points out that considering surprise in the light of the five criteria of an emotion stated by him (which include those of McDougall and Shand), there is no adequate reason for the exclusion of surprise from the group of emotional tendencies. He finds that, besides the ten tendencies mentioned by him, surprise is the only other emotional tendency which has a serious claim to be included in the group of emotional 'instinct' tendencies.[6]

Drever's view that surprise has good claims to be classed as an emotion seems acceptable.

If the tendency to pay attention to its stimulus found in surprise is regarded as the conative tendency of that emotion, then the principal objection against its being considered a primary emotion—the objection that it has no conative impulse—will be removed. The suggestion that surprise be regarded as the emotional aspect of the process of involuntary attention is not as fantastically speculative as it seems at first sight. The association of shock with consciousness

[1] Shand, *Foundations*, p. 421.
[2] *Ibid.* p. 430.
[3] *Ibid.* pp. 436 sq.
[4] *Ibid.* p. 437.
[5] Drever, James, *Instinct in Man*, p. 173.
[6] *Ibid.* pp. 169 sqq.

was observed as early as Plato's[1] time, and Spencer has propounded a theory according to which all consciousness is of the nature of a shock.[2] In view of the fact that surprise is regarded as a psychic shock, may it not be that the shock of consciousness[3] is experienced as surprise during the process of involuntary attention in which an object is brought to full consciousness? May it not be that in its origin all attention involves the shock of surprise, and that only in its later forms adaptation and habituation enable it to occur without the emotional disturbance which marked its initial emergence?

Surprise in phylogenesis and ontogenesis

The answer to the question as to the level of evolution at which surprise is first found must be necessarily of a speculative nature and must involve considerable danger of anthropomorphism. Due allowance must be made for this fact in considering the views on this question.

[1] Plato distinguishes between affections of the body which fail to reach the soul and others which 'vibrate through both soul and body, and impart a shock to both and each of them'. The former state in which the soul is not affected by the shocks is 'unconsciousness' (Jowett, B., *The Dialogues of Plato*, vol. IV, 'Philebus', 33 and 34, pp. 602 sq.). Can it not be inferred from this that consciousness implies an experience of shocks?

[2] Spencer, Herbert, *Psychology*, vol. I, pp. 147 sqq. A similar view is adopted by Allen (Allen, A. H. Burlton, *Pleasure and Instinct*, p. 90).

[3] There are indications that the nature of the stimulus of surprise and the short duration of the emotion may be, each of them, conducive to heightened consciousness. In connexion with shocks experienced by nerves, Matthews found that a shock is experienced in relation to a change in electrical current used for stimulation while a continuous current leads to habituation. A shock is experienced even when the change is brought about by a removal of the current (Matthews, Bryan C., *Electricity in Our Bodies*, p. 98). In his work on the electrical nature of the nerve impulse, Adrian points out that to obtain the maximum frequency of discharge in a sense organ 'the stimulus must not only reach a great intensity but must reach it very quickly' (Adrian, E. D., *The Mechanism of Nervous Action*, p. 25). In this connexion it is interesting to note the work of McDougall and Flügel on the variation of the intensity of visual sensation with the duration of the stimulus. They found that when the duration of stimulation is prolonged beyond the 'action-time', the intensity of sensation declines very rapidly, 'and more rapidly the more intense the sensation, the more intense sensation declining to 50 % of its initial value in about 1/40 sec.' (Flügel, J. C. and McDougall, Wm., 'Further observations on the variation of visual sensation with the duration of the stimulus', *Brit. J. Psychol.* vol. III, p. 205, 1909–10. 'Action-time' is defined by McDougall as 'the least time during which a light of given intensity must act upon the retina in order to produce its full effect in sensation' in his article on 'The variation of the intensity of visual sensation with the duration of the stimulus', *Brit. J. Psychol.* vol. I, pp. 151 sq., 1904). In an earlier work McDougall had observed that a brief stimulus to the eye excites a multiple response, a rapid series of pulses of diminishing brightness. But if the stimulus is other than very brief, such a response is not elicited. The sensation simply persists for a moment and then terminates ('The sensations excited by a single momentary stimulation of the eye', *Brit. J. Psychol.* vol. I, pp. 78–115, 1904).

Romanes and Marshall believe that surprise occurs very early in the evolutionary scale. It is ascribed by Romanes to animals as low in the evolutionary scale as the larvae of insects.[1] It is to be noted that, according to Romanes, surprise makes its appearance at the same level of evolution at which the rise from sensation to perception occurs.[2] Marshall believes that surprise was one of the earliest emotions to evolve.[3] Stanley Hall thinks that shock can be found in all animals from invertebrates upwards and even in plants.[4]

Lindsay refers to surprise in dogs, cats, sheep and birds.[5] Darwin observed it in a number of animals,[6] and he describes the facial expression of the emotion in monkeys,[7] while Yerkes refers to surprise in the gorilla[8] and the chimpanzee.[9]

Thomson, who believes that only the most intelligent animals are capable of experiencing astonishment,[10] thinks that surprise is perhaps first found in birds.[11] Rosmini, however, regards surprise as peculiar to man.[12] His view is based on the belief that surprise is an 'intellective passion' and therefore can be experienced only by man who alone is rational.

As regards the appearance of surprise in ontogenesis, authoritative opinion is agreed that surprise occurs very early.[13]

McCosh,[14] Romanes,[15] and Ribot[16] are of the opinion that surprise appears very early in the infants, and Ladd affirms that it is 'the first feeling'.[17]

Shock or startle reactions have been observed during the first

[1] Romanes, *Mental Evolution in Animals*, p. 341. [2] *Ibid.* diagram on p. 66.

[3] Marshall, *Instinct and Reason*, p. 120.

[4] Hall, Stanley, 'A synthetic, genetic study of fear', *Amer. J. Psychol.* vol. xxv, p. 161, 1914. In his article on 'Jealousy' (*Amer. J. Psychol.* vol. xvii, 1906), Arnold Gesell refers to the appearance of new psychic states in mental evolution and regards surprise, with fear and anger, as one of the earliest to evolve.

[5] Lindsay, W. L., *Mind in the Lower Animals*, vol. ii, pp. 116 sq., 120, 224 sq. and 241.

[6] Darwin, *The Expression of Emotions*, p. 316. [7] *Ibid.* pp. 144 sq.

[8] Yerkes, Y. M., 'The mind of the gorilla', *Genet. Psychol. Monogr.* vol. ii, p. 25, 1927.

[9] Yerkes, *The Great Apes*, p. 311. In this connexion may be noted the statement of Keeper Shelley of the London Zoo who said with reference to Jubilee, the baby chimpanzee: 'She is too young to show her feelings in a practical way and she only registers surprise' (*Evening Standard*, 9 Sept. 1935).

[10] Thomson, Edward, *Passions of Animals*, pp. 124 sq. [11] *Ibid.* pp. 125 sq.

[12] Rosmini, *Psychology*, vol. ii, pp. 185 sq.

[13] Brown, Thomas (*op. cit.* 3rd ed. p. 345), and Martineau, James (*Types of Ethical Theory*, vol. ii, pp. 151 sq.), however, believe that infants are incapable of experiencing surprise. But their belief is apparently an inference based on a restricted view of the stimulus of surprise. [14] McCosh, James, *The Emotions*, p. 137.

[15] Romanes, *Mental Evolution in Man*, p. 7.

[16] Ribot, *The Psychology of Attention*, p. 37.

[17] Ladd, G., *Psychology, Descriptive and Explanatory*, p. 540.

days of infancy.[1] Mrs Shinn observed a start in the infant immediately after birth 'when the scale of the balance in which he was lying... sprang up'.[2] 'Start at a sound or jar' was noticed by her on the first day.[3] McGraw refers to the Moro (or body-startle) reflex which occurs at birth.[4] There is a tendency, however, to ascribe 'genuine surprise' to a much later period.[5]

If it is admitted that only the rudiments of an emotion can be expected in the infant, and further that startle possesses an element of surprise, then surprise must be regarded as appearing extremely early in ontogenesis. Perhaps in its earliest appearance, surprise occurs in association with fear while at a later stage it is associated with wonder or curiosity. The designation of 'genuine surprise' is applied erroneously, in all probability, to surprise of the later kind.

The affinities of surprise

There are two groups of emotions with which surprise is believed to be particularly related—emotions like fear and emotions like wonder and curiosity. From early times surprise has been associated with fear.[6] Descartes considered surprise as the principal cause of, and an essential element in, all fear.[7] The relationship of surprise to fear seems so close that there are frequent references to surprise in connexion with fear and certain types of fear, such as those occurring in startle and fright, may be said to contain, invariably, an element of surprise.[8] Again, of the two elements of startle—surprise and fear—

[1] Maine de Biran, *The Influence of Habit*, p. 104; Darwin, 'A biographical sketch of an infant', *Mind*, p. 286, 1877; Preyer, *The Mind of the Child*, part I, pp. 172 sq.; Perez, B., *The First Three Years of Childhood*, p. 7; Stern, *Psychology of Early Childhood*, p. 18; Bühler, Charlotte, *From Birth to Maturity*, pp. 54 sq.; Gesell, A., also ascribes startle to an early stage in infancy (*Infancy and Human Growth*, p. 129, and *The Guidance of Mental Growth in Infant and Child*, pp. 163 sq.).

[2] Shinn, *Notes on the Development of a Child*, p. 49.

[3] *Ibid.* p. 28.

[4] McGraw, M. B., *Growth*, pp. 45 sqq.

[5] Shinn, *op. cit.* pp. 85 sq.; Stanley, Hiram, *op. cit.* p. 52; Stern, *op. cit.* p. 125.

[6] E.g. according to the Stoics (Diogenes, *Ancient Philosophers*, pp. 529 sq. and Cicero, *op. cit.* pp. 347 sq.), Nemesius (*op. cit.* p. 389), and Ibn Sinna, who mentions under the heading of fear (Timor) sixty-nine emotions or shades of emotions, among which are included 'aghast, alarmed, astounded, startled and terror-struck' (Cameron, O., *A Treatise on the Cannon of Medicine of Avicenna*, pp. 152 sqq.).

[7] *Op. cit.* art. CLXXIV, p. 411.

[8] Cf. Darwin, *op. cit.* p. 306; Lewes, *Problems of Life and Mind*, pp. 383 sq.; Wundt, *Human and Animal Psychology*, p. 376; Hall, Stanley, 'A study of fears', *Amer. J. Psychol.* vol. VIII, pp. 197 sqq., 1896–7 and 'A synthetic, genetic study of fear', *Amer. J. Psychol.* vol. XXV, pp. 149–200, 1914; Mosso, A., *Fear*, p. 242; Woodworth, *Psychology*, p. 300; Allport, *Social Psychology*, p. 95; Valentine, 'The innate basis of fear', *Ped. Sem.* vol. XXXVII, pp. 399 sqq., 1930. Cf. also the meanings of surprise and startle given in *Dictionary of Psychology* (ed. Warren). Freud has laid particular stress on the element of surprise in fright.

one or the other is often ignored so that some writers treat startle as equivalent to surprise while others consider it identical with fear.[1]

As for the association of surprise with wonder and curiosity, it has been explicitly recognized since Descartes who himself made no very clear distinction between surprise and wonder.[2] Many subsequent philosophers and psychologists have considered surprise as a part of the 'intellectual sentiment' or as one of the emotions connected with it.[3]

There has been some difficulty, however, in making a qualitative distinction between surprise and wonder and in determining the temporal relationship of surprise, wonder and curiosity.

Thomas Brown,[4] Bain[5] and Bhagavan Das[6] have made no adequate distinction between surprise and wonder. Indeed, Wundt makes no qualitative distinction between the two whatever and regards wonder as merely surprise when 'it has passed into a more permanent mood'.[7] Yerkes holds a similar view.[8]

Adam Smith made an attempt to distinguish between surprise and wonder. The basis of distinction adopted by Smith was the different nature of the stimuli which in the case of surprise were unexpected, in that of wonder, new and singular.[9] Shand thinks that it is the absence of curiosity that distinguishes surprise from wonder.[10] Further, he says that while surprise is very transient wonder is one of the most prolonged emotions.[11] If this fact is borne in mind, then on this ground alone it would be possible to reject the view that an element of surprise is contained in all wonder. Indeed, Shand points out that wonder commences only after the first shock of surprise.[12]

[1] Such is the case in a number of experimental investigations which will be referred to later in connexion with the expressions of surprise.

[2] Descartes regarded wonder as sudden surprise and surprise as an element in wonder and also as the cause of wonder (*op. cit.* pp. 362 sq.).

[3] E.g. Bain, *op. cit.* (3rd ed.), p. 75; Rosmini, *op. cit.* pp. 185 sq.; Maher, *op. cit.* p. 432; Ribot, *The Psychology of Emotions*, pp. 368 sq.; Sully, *Outlines of Psychology*, p. 361; Irons, *op. cit.* p. 104; Hollingworth, *Psychology—its Facts and Principles*, p. 358; and Allen, *Pleasure and Instinct*, p. 112.

[4] Brown considers surprise and wonder 'at least as an emotion, the same' (*op. cit.* pp. 345 sq.) even though he regards wonder as 'a mixture of inquiry and emotion' (*ibid.* p. 346).

[5] Bain thinks that surprise is an element in wonder, but the latter involves also the effect produced by the contemplation of the extraordinary (*op. cit.* p. 75).

[6] Das, Bhagavan, *The Science of the Emotions*, pp. 94 sq.

[7] Wundt, *Human and Animal Psychology*, p. 376.

[8] Yerkes, *Introduction to Psychology*, p. 182.

[9] Smith, Adam, *op. cit.* p. 325.

[10] Shand, *Foundations*, p. 430.

[11] *Ibid.* p. 445.

[12] *Ibid.*

As for the temporal relationship between the two, most authors who have classed surprise as an intellectual feeling or emotion agree that surprise precedes wonder.[1] Drever points out that when the situation does not arouse fear, anger or some such emotion but continues to present a question, the surprise passes not into wonder but into curiosity. Wonder arises only when curiosity is baffled.[2]

Astonishment, amazement, bewilderment and complex emotions of this nature may be regarded as arising by virtue of the affinity of surprise with wonder and curiosity. A few authors have considered astonishment as merely a stronger degree of surprise,[3] but the view that it arises out of surprise as well as baffled curiosity[4] seems more acceptable. Surprise is believed to be involved in all admiration.[5] It is also related to experiences like contrast[6] and disappointment,[7] probably owing to the common elements in, or the similarity of, the situations which arouse these three reactions.

Surprise is thus closely related to emotions of the type of fear and curiosity or wonder and may easily pass over into one of these emotions. Probably this is so because the lack of adaptation implied in surprise is conducive to the operation of processes connected with self-preservation[8] and assimilation.

[1] Martineau, however, thinks that the order of occurrence is (*a*) wonder at the unknown, (*b*) custom and expectation of the known, (*c*) surprise at the exceptional (*op. cit.* p. 153). Dewey adopts a similar view (*Psychology*, pp. 303 sq.). The view seems to be based on a narrow definition of the stimulus of surprise.

[2] Drever, *op. cit.* p. 200. The connexion of surprise with curiosity has been observed by Nathan Isaacs ('Children's "Why" Questions' in Susan Isaacs's *Intellectual Growth in Young Children*, pp. 295 sqq.) and by R. V. Feldman ('The metaphysics of wonder and surprise, *Philosophy*, vol. IX, p. 209, 1934).

[3] E.g. Descartes, *op. cit.* art. LXXIII, pp. 363 sq.; Darwin, *op. cit.* p. 293; Yerkes, *Introduction to Psychology*, p. 182.

[4] Wundt, *Human and Animal Psychology*, p. 376; Thompson, *op. cit.* p. 567; Maher, *op. cit.* p. 433; Shand, *Foundations*, p. 446; Drever, *op. cit.* p. 200.

[5] Cf. Darwin, *The Expression of Emotions*, p. 306; Shand, *Foundations*, p. 448.

[6] Referred to by Sydney Smith (*op. cit.* p. 367) and by Flügel and McDougall ('Some observations on psychological contrast', *Brit. J. Psychol.* pp. 355 sq., 1914).

[7] Wundt, *Human and Animal Psychology*, p. 376; Stanley, Hiram, *op. cit.* pp. 163 sq.

[8] It seems possible that surprise is also related to anger, especially when it arouses a negative self-feeling. In cases of this nature anger in milder forms (like annoyance) is likely to arise. Hume associated surprise with pride. 'There is nothing in us or belonging to us, which produces surprise, that does not at the same time excite that other passion' (Hume, David, *Treatise on Human Nature*, vol. I, pp. 97 sq.). Judging from the illustrations given by him, Hume seems to mean that it is not the experience of surprise in oneself but rather its induction in others that may lead to pride in the individual. If this is what he meant, then Hume made a useful observation on the role of extraordinariness in social evaluations. The view is, however, too sweeping, since whether one is to experience pride or not will depend upon the nature of one's behaviour which has caused surprise in others. Indeed the expression of surprise in others in relation to an individual may lead to a wide range of emotional experiences in the individual who is the cause of surprise, including surprise itself.

Surprise often mixes with other emotions,[1] and it has been even held that all emotions commence with the shock of surprise.[2] According to Shand surprise mixes more readily with some emotions than with others.[3]

It has been held that surprise tends to heighten the intensity of the emotions which blend with it or follow it.[4] Shand states this tendency by saying that 'surprise tends to increase the intensity of every emotion with which it blends, or by which it is rapidly followed'.[5] A similar enhancive effect is attributed to surprise in relation to pleasure and unpleasure.[6]

The close connexion of surprise with emotions and its tendency to enhance their intensities is explicable on the basis of the lack of adaptation and the state of suspended action involved in surprise, which make it an excellent breeding ground for strong emotional reactions. It seems that surprise, through its effect on the organism, causes a change in the subject-object relationship, of such a nature that stimuli which have normally no emotional significance acquire that quality for the time being when they catch the organism, as it were, in a surprised state—in a state of unpreparedness.

There are certain other experiences to which surprise is believed to be related in some way. It is frequently referred to, implicitly or explicitly, in connexion with laughter. Suddenness is frequently regarded as the necessary condition for laughter.[7] Surprise is believed

[1] Cf. Irons, *op. cit.* p. 104; Shand, *Foundations*, p. 421.

[2] Descartes, *op. cit.* art. LIII, p. 358; Smith, Adam, *op. cit.* p. 327; Ladd, *Physiological Psychology*, p. 518.

[3] Shand, *Foundations*, p. 421. Shand had pointed out that the emotions, which Ribot distinguished from passions on the ground of their intensity and brevity, are those which commence with surprise while others have a gradual origin ('M. Ribot's theory of the passions', *Mind*, vol. XVI, pp. 478 sq., 1907). It is a question, however, whether in its initial inception at least, every emotion does not involve an element of shock akin to surprise.

[4] Cf. Descartes, *op. cit.* art. LIII, p. 358; Malebranche, *op. cit.* vol. II, p. 72; Hutcheson, *Passions and Affections*, pp. 79 sq.; Smith, Sydney, *op. cit.* p. 337. Indications of the observation of this tendency are found in the Stoics (who thought that anticipation mitigates distress [Cicero, *op. cit.* p. 261]), in the Sceptics (Sextus Empiricus, *op. cit.* vol. I, p. 84) and in Thomas Aquinas (*Summa Theologia*, vol. VI, pp. 283 sq.).

[5] Shand, *Foundations*, p. 421. This tendency appears to be implicitly assumed in some experimental works on emotions, e.g. by Shepard, Starch, Wechsler, Blatz, Bayley and Duffy (whose investigations will be referred to later in connexion with the expressions of surprise), since some of the stimuli were given 'suddenly and without the knowledge of the subject'.

[6] Aristotle, *Rhetorica*, bk. II, 2, 137*a*; Hartley, David, *Observations on Man*, p. 220; Smith, Sydney, *op. cit.* p. 375; Stout, *Analytic Psychology*, vol. II, pp. 275 sq.

[7] Cf. for instance, the 'sudden glory' or 'degradation' theory of Thomas Hobbes (*Humane Nature*, p. 101); Kant's view that laughter is based on 'the sudden transformation of a strained expectation into nothing' (*Kritik of Judgment*, trans. Bernard, p. 223);

by some to be an antecedent or a cause of laughter.[1] It has been pointed out, however, that surprise cannot lead to laughter if the situation arouses some strong emotion.[2]

It is thought that in the laughter of tickling also surprise is involved.[3]

Sully asserts that 'surprise is not an invariable antecedent of our response to laughable things'.[4] He thus points out that the quality of being 'laughable' is independent of surprise. Sully believes that the role of surprise in 'the enjoyment of the laughable has been exaggerated'.[5] Regarding the function of surprise in relation to laughter, he thinks that it is because surprise is 'a common condition of vivid and exciting impressions, certainly of those which induce a state of gladness', that it is found among the antecedents of that 'outburst of gladness which we call laughter'.[6] Thus according to Sully surprise is connected with laughter only in so far as it is connected with 'gladness'. Even if Sully's view of the stimulus of laughter is rejected, his observation as to the independence of that stimulus from surprise seems acceptable.

Sully thinks that surprise has an enhancing effect on the 'feeling of the ridiculous'.[7]

Surprise is also deemed to be involved in experiences connected with wit, jokes, humour, the comic, the ridiculous, irony, puns, sarcasm

Schopenhauer's theory that in laughter there is a sudden perception of an incongruity (*World as Will and Idea*, vol. I, pp. 76 sq.) and the recent 'relief' theory of Gregory who thinks that in laughter there is a psychic shock. 'Suddenness', he says, 'pervades all laughter' (Gregory, J. C., *The Nature of Laughter*, pp. 29 sq.).

[1] Descartes, *op. cit.* p. 387. David Hartley refers to surprise as a cause of laughter in children (*op. cit.* p. 149) and considers that emotion as the first occasion for laughter in the infant (p. 258). James Beattie thought that laughter is caused by a 'surprising incongruity' (*Essays: On Laughter and Ludicrous Composition*, p. 418). For Leigh Hunt surprise is an invariable antecedent of laughter. He states that in proportion to the degree of surprise the breath receives a check. It 'recedes only to re-issue with double force; and the happy convulsion it undergoes in the process is laughter' (*Wit and Humour*, pp. 6 sqq.). In his genetic study of laughter Kimmins found that 'surprise followed by a relief from strain' is responsible for much laughter from the Bo-peep of infancy through the whole school-life' (*The Springs of Laughter*, p. 37). William Hazlitt regards 'mere surprise or contrast' as the cause of laughter (*Wit and Humour and Other Essays*, p. 3).

[2] Beattie, James, *op. cit.* pp. 424 sqq., and Hazlitt, *op. cit.* p. 3. Sully observes that laughter occurs sometimes under great emotional tension, 'especially when it includes something in the nature of a shock' (*An Essay on Laughter*, pp. 66 sq.).

[3] Kimmins thinks that an element of surprise 'must be present in the sensations which lead to the laughter of tickling' (*op. cit.* p. 78). Hall and Allin refer to the presence of shock in tickling ('The psychology of tickling, laughing and the comic', p. 12) and Sully says that in the laughter of tickling there is 'a slight shock at the approach of something partially unknown' (*An Essay on Laughter*, p. 64).

[4] Sully, *An Essay on Laughter*, p. 142. [5] *Ibid.* p. 129. [6] *Ibid.* [7] *Ibid.* p. 12.

and buffoonery.[1] Its utility in play,[2] in rhyme and poetry,[3] in drama and rhetoric,[4] and in aesthetic experience[5] has been also indicated.

There has been no adequate explanation of the relationship of surprise with laughter and the other experiences mentioned above. The observations, however, indicate that surprise probably plays an important role in relation to these experiences.

[1] Cf. Aristotle, *Rhetorica*, bk. III, 2, 1412*a*; Montaigne, *Essays*, vol. II, p. 39; Beattie, *op. cit.* p. 422; Schopenhauer refers to surprise in connexion with wit as well as folly (*op. cit.* pp. 76 sq.); Hunt, Leigh, *op. cit.* p. 8; Hazlitt, *op. cit.* p. 24; Hoffding, *Outlines of Psychology*, p. 297; Karl Groos regards the neglect of the element of surprise as responsible for the failure of attempts to explain the comic (*The Play of Man*, p. 165); Hall, Stanley, and Allin, *op. cit.* p. 27. Dugald Stewart, who deals at some length with wit, rhyme and poetry, attaches considerable importance to the relationship of these with surprise. He says that the entertainment of wit is founded, to a considerable degree, on the surprise 'at the command which the man of wit has acquired over a part of his constitution which is so little subject to the will' (*The Philosophy of the Human Mind*, p. 301). But the pleasure is not solely due to surprise. There must be 'an unexpected analogy or relation between different ideas, and perhaps other circumstances combine to render the wit perfect' (p. 307). Later, however, he materially modifies this view of the indispensability of surprise in wit when he says: 'All that I affirm is that when an analogy or relation is pleasing in itself, our pleasure is heightened by our surprise at the author's habits of association when compared with our own' (p. 309). According to Sydney Smith, wit deals with relations between ideas, but an element of surprise is indispensable to wit (*op. cit.* p. 119). He goes so far as to assert that 'any surprising relation whatever produces some slight sensation of wit'. But there are limitations. 'There must be no feeling or conviction of utility of the relations', nor should these excite aesthetic experience, or any powerful emotion or passion (pp. 119 sq.). The theory of the relationship of surprise to wit applies, according to Smith, to puns, irony, humour, sarcasm, and buffoonery with modifications only in connexion with the type of material utilized in these experiences (pp. 125 sqq.). Reik, who considers surprise tremendously important in analytical procedure, emphasizes the role of surprise in wit (*Surprise and the Psycho-Analyst*). There is an inner likeness between analytical explanation and jokes. Both in analysis and in wit 'the effect of surprise is secured by suspending the exertion of suppression and inhibition' (p. 63). 'A man who hears a joke laughs like someone who gets a sudden shock and realizes at once he need not be alarmed.' In a similar manner 'the analyst's communications produce a kind of shock in the patient, for the moment his preparedness for inhibition is enhanced and slowly overcome....Here then is a feature common to the psycho-cathartic effect of the analytical process and of wit' (*ibid.*).

[2] Hall, Stanley ('A synthetic, genetic study of fear', pp. 172 sq.); Groos, Karl (*op. cit.* p. 164), and Kimmins (*op. cit.* p. 37) refer to the importance of surprise in the play of children. It may be noted here that Thomas Hobbes regards 'sudden dejection' as the cause of weeping (*Leviathan*, p. 34).

[3] Aristotle (Bywater, *Aristotle on the Art of Poetry*, p. 40); Stewart, Dugald (*op. cit.* pp. 306 sqq.) attaches considerable importance to surprise in connexion with rhyme and poetry as he did in the case of wit.

[4] Aristotle (Bywater, *op. cit.* pp. 45 sq.) observed that the tragic pleasure in drama is enhanced by 'a great surprise'. He also mentions the utility of surprise in rhetoric (*Rhetorica*, bk. III, 2, 1412*a*).

[5] Plato refers to three degrees of wonder in aesthetic experience. Each of these seems to commence with an experience akin to surprise since Plato mentions 'sudden arrest' of existing reactions (Stewart, J. A., *Plato's Doctrine of Ideas*, pp. 135 sqq.). Plotinus observes the presence of 'pleasure, astonishment and admiration' in the contemplation of beauty (Guthrie, K., *Plotinus—Complete Works*, vol. I, pp. 44 sq.).

The place of surprise among different classifications of emotions

Surprise has been regarded by some as an emotion associated with the exercise of the intellect.[1] Bain calls it one of the 'emotions of relativity', the objective cause of which is a 'purely relative circumstance'.[2] According to Baldwin, surprise is one of the 'time-emotions' which fall under the general heading of 'logical emotions'. Surprise attaches 'to the idea of the immediate present'.[3] McCosh, however, placed surprise among the 'prospective emotions'—those looking to the future—which emotions are 'the main stimulants of activity'.[4] For Thompson surprise is one of the 'feelings of attention'.[5] Romanes groups it under 'emotions preservative of self'.[6] Wundt regards it as one of the emotions which are 'sudden and irruptive',[7] and like all such emotions it is considered asthenic.[8] Warren terms restiveness, surprise and anxiety as 'emotions of uncertainty'.[9]

Surprise is thus classified according to whether it is considered from the point of view of its stimulus, reaction, duration or affinities.

The expressions of surprise

There appears to be general agreement as to the characteristics of the facial expression of surprise.

The eyebrows are raised and the eyes and mouth are widely open.[10] Experiments on the facial expressions of emotions indicate that the

[1] Rosmini calls surprise an 'intellective passion' (*op. cit.* pp. 185 sq.). Maher calls novelty, surprise, wonder and astonishment 'feelings attached to intellectual activity' (*op. cit.* pp. 432 sq.). Ribot and Sully consider surprise a part of the 'intellectual sentiment' (Ribot, *The Psychology of Emotions*, pp. 368 sq.; Sully, *Outlines of Psychology*, p. 361). Irons calls surprise, astonishment and wonder 'intellectual feelings' (*op. cit.* p. 104). Hollingworth includes surprise together with curiosity, wonder, expectation, congruity, harmony, assent, disagreement, disappointment, conviction and assurance, among 'the higher or intellectual feelings' (*Psychology—its Facts and Principles*, p. 358).

[2] Bain (*op. cit.* pp. 83 sq.). Under this designation also fall novelty, wonder and strangely enough, 'power' and 'liberty'. M. F. Washburn regards surprise as one of the 'relational processes' (*Movement and Mental Imagery*, p. 198).

[3] Baldwin, J. M., *Handbook of Psychology*, p. 197.

[4] *Op. cit.* pp. 136 sq.

[5] *Op. cit.* p. 566.

[6] *Mental Evolution in Man*, p. 344.

[7] *Outlines of Psychology*, pp. 198 sq.

[8] *Ibid.*

[9] Warren, H. C., *Human Psychology*, p. 300. R. B. Cattell has regarded surprise as an emotion associated with 'primary subjectivity' which occurs only 'in the first instant of the presentation of a stimulus' ('The subjective character of cognition', *Brit. J. Psychol. Monogr. Suppl.* vol. v, No. 14, pp. 14 sqq., 1930).

[10] Cf. Darwin, *op. cit.* p. 293. The universality of this expression of surprise is borne out, according to Darwin, by an ethnological study of expressions (p. 294). Preyer, *op. cit.* p. 23. Dumas, agreeing with Frappa's view, thinks that all expressions are derived from the expressions of astonishment, sadness, and joy (*Traité de Psychologie*, vol. I, pp. 635 sqq.).

expression of surprise is readily recognized.[1] It is, however, not always easy to distinguish it clearly from the similar expressions of fear and of attention.[2] Landis concludes that 'there is no facial pattern of reaction... which characterizes any particular "feeling"'.[3] Considering his method of evoking 'surprise' by the employment of startle stimuli, together with the facts of the short duration of surprise and the ease with which it blends with other emotions, it seems that Landis has no adequate data to dismiss the possiblity of a pattern facial response in relation to surprise.[4] Landis himself states at another place that the expression of surprise is 'dependent on the survival of primitive connexions within the nervous system'.[5]

Exclamations have been observed in connexion with surprise.[6] Shand thinks that the attitude in surprise is essentially exclamatory.[7]

A large number and variety of physiological consequences are attributed to shock.[8] Surprise is sometimes mentioned in connexion

[1] Cf. Ruckmick, C. A., 'A preliminary study of the emotions', *Psychol. Rev. Monogr.* vol. xxx, pp. 30 sqq., 1921. Feleky, Antoinette, *Feelings and Emotions*, pp. 134, 183–7, 190 and 193. Jarden, Ellen and Fernberger, Samuel, 'The effect of suggestion on the judgment of facial expression of emotion', *Amer. J. Psychol.* vol. xxxvii, pp. 565–70, 1926. Jeness, Arthur, 'Differences in the recognition of the facial expression of emotion', *J. gen. Psychol.* vol. vii, pp. 192 sqq., 1932.

[2] Cf. Bell, Charles, *Essays on the Anatomy of Expression*, pp. 142 sq., and *The Anatomy and Philosophy of Expression*, pp. 152 sq.; Dumas, *Nouveau Traité de Psychologie*, vol. iii, pp. 119 sqq.; Ruckmick, *op. cit.* pp. 30 sqq.; and Boring, Edwin and Titchener, E., 'Model for demonstration of facial expression', *Amer. J. Psychol.* vol. xxxiv, p. 481, 1923. In this connexion it is interesting to observe the similarity between the expression of surprise and the expression in Fright—Basedow which, according to Gabriel Langfeldt, is developed in direct connexion with shock (*The Endocrine Glands and Autonomic Systems in Dementia Praecox*, p. 281).

[3] Landis, Carney, 'Studies of emotional reactions. II. General behaviour and facial expression', *J. comp. Psychol.* vol. iv, p. 493, 1924. In this experiment Landis employed a startle stimulus and took photographs of the subject. In a subsequent investigation in which he employed the photographs obtained in the experiment mentioned above, he concluded that the names given to expressions were no more correct than one would expect by chance ('Interpretation of facial expressions in emotions', *J. gen. Psychol.* vol. ii, p. 69, 1929).

[4] Gardner Murphy and Lois Barclay Murphy find Landis's evidence for his conclusion inadequate (*Experimental Social Psychology*, p. 79).

[5] Landis, Carney, 'The expressions of emotion' in *The Foundations of Experimental Psychology*, p. 500.

[6] E.g. Clarke, H. M., *op. cit.* p. 225; Boring, Langfeld, Weld and collaborators, *Psychology*, p. 410.

[7] *Op. cit.* p. 430.

[8] Cf. Crile, G. W., who lays stress on the effect of shock on the vasomotor mechanism and in that connexion regards cardiac and respiratory effects as also important (*An Experimental Research into Surgical Shock*, p. 151). Stanley Hall frequently mentions surprise and startle in connexion with shock, which he distinguishes from fear by saying that in shock, unlike fear, anticipation of pain is lacking ('A synthetic, genetic study of fear', *Amer. J. Psychol.* vol. xxv, p. 161, 1914). Regarding the effects of shock he says that

with shock and its effects, but no adequate distinction is made between shock, surprise and startle, so that it is not possible to say what effects belong to surprise as such.

In some of the work on emotions in which the expression method has been employed, the effects of surprise or startle have been directly or indirectly investigated. The results obtained so far need to be regarded with considerable caution and reserve. The investigations are few, the number of subjects employed is almost always inadequate, the stimuli most frequently employed have been either of a violent nature or such that fear or some other strong emotion was bound to arise. This last fact has led to a confusion between the terms startle and surprise and has led to the possibility of errors in the interpretation of the experience to which the expressions are believed to belong. When to this are added the facts that surprise has generally a very brief duration, and therefore requires precise methods of investigation, and that the indicators are themselves considered to be far from infallible and indeed as liable to grave errors, the necessity of a cautious attitude towards the results becomes obvious.

Psycho-galvanic response. Relatively speaking, the most extensive and reliable work is done in relation to the p.g.r. This response appears to be easily evoked under surprise or at any rate under startle.[1]

'shock may find its chief expression in any part or function of the alimentary canal, bringing all types of modifications of every anabolic and katabolic stage and process. The circulatory system, respiration, the voluntary muscles—all may be affected in varying degrees and sometimes intensely enough to cause complete cessation of process or function, e.g. paralysis' (*ibid.*). Henri Pieron also mentions widespread effects, 'besides some expressive manifestations of surprise', in connexion with mild emotional shocks. These effects show themselves particularly in relation to the vascular and respiratory systems and include 'inhibitions of the tone and activity of the smooth muscles of the walls of the stomach and intestines or of the sphincters' (*Principles of Experimental Psychology*, pp. 44 sq.). In this connexion may be mentioned the abolition of peristalsis under startle referred to by Cannon, W. B. (*Bodily Changes in Pain, Hunger, Fear and Rage*, p. 14), and the startle effects observed by Philip Bard in a decorticated cat ('On emotional expression after decortication', part II, *Psychol. Rev.* vol. XLI, pp. 424 sqq., 1934).

[1] Starch, Daniel, using an unexpected bell-ring, found a close relationship between startle and the p.g.r. ('Mental processes and concomitant galvanometric changes', *Psychol. Rev.* vol. XVII, pp. 19–36, 1910). David Wechsler found that deflexions occurred most frequently after fear or surprise stimuli ('The measurement of emotional reactions', *Arch. Psychol.* No. 76 p. 35, 1925). R. J. Bartlett observed that when 'something unexpected happens' marked 'shock experiences result and these are accompanied by deflexions ('Does the psycho-galvanic phenomena indicate emotion?' *Brit. J. Psychol.* pp. 46 sq., 1927). Nancy Bayley found that the response is generally elicited by startle stimuli ('A study of fear by means of the psychogalvanic technique', *Psychol. Rev. Monogr.* vol. XXXVIII, pp. 21 sq., 1928). E. M. Westburgh found 'surprise deflexions' when no preparatory signal was given before the stimulus ('Psychogalvanic studies of normal and abnormal subjects', *Arch.*

Indeed, it has been held that the p.g.r. is correlated with shock, surprise or startle to a more marked degree than with other experiences.[1] Some of the work with the p.g.r. gives indirect evidence of the tendency of surprise to increase the intensity of the emotions which blend with it or immediately follow it.[2]

Respiration. There is some indication that there might be a temporary check in breathing under surprise followed by a disturbance in the inspiration-expiration ratio.[3]

Neurol. Psychiat. vol. XXII, p. 459, 1929). T. M. Abel observed 'a fairly definite functional connexion between electrical changes in the skin and certain reportable attitudes... which mark sudden, decided and momentary checks in the course of the comprehension' ('Attitudes and the galvanic skin reflex', *J. exp. Psychol.* vol. XIII, p. 60, 1930). Patterson's experiments showed that surprise led to a wide range of deflexions (*op. cit.* p. 95).

[1] Wechsler concluded that 'the greatest responses were elicited by surprise or pain excitations' (*op. cit.* p. 141). Bartlett thinks that the p.g.r. is specially connected with a complex orectic process in which the first phase is of the nature of shock, start, surprise or astonishment (*op. cit.* p. 47). Bayley concluded that 'by far the greatest deflexions are occasioned by stimuli causing emotions which are described as startle, surprise or shock' (*op. cit.* pp. 22 sq.). C. Landis and W. A. Hunt, employing adequate precautions regarding the technique of experimentation and using a wide range of stimuli, found that the response occurs in relation to a variety of stimulations but 'seems to be more nearly related to startle or to tension than to anything else' ('The conscious correlate of the galvanic skin response', *J. exp. Psychol.* vol. XVIII, pp. 505–28, 1935).

[2] Starch concluded that emotions which are accompanied by a start or shock produce the largest deflexions (*op. cit.* p. 36). Wechsler, using an induction shock, a Klaxon horn and a flash of magnesium as stimuli, found that the second response for the same stimulus was 'almost invariably smaller than the first' (*op. cit.* p. 141). In another experiment a Klaxon horn was sounded four times during a series of twenty-one stimulations. The results show that the first sounding of the horn caused the largest deflexions (Wechsler, Crabbs and Freeman, 'Galvanic responses of pre-school children', *J. Genet. Psychol.* vol. XXXVIII, pp. 203–22, 1930). Westburgh observed that giving a signal before a stimulus, which eliminated surprise, caused a reduction in the size of the deflexions (*op. cit.* p. 459). Patterson found that 'the largest deflexions were caused by fear stimuli, especially those of the nature of startle' (*op. cit.* p. 96).

[3] Johannes Müller had observed that any sudden change in the state of the brain immediately causes a change of action in the respiratory muscles (*Elements of Physiology*, vol. II, p. 932). Lehmann found that the 'alarm' correlated with a sudden powerful change in the direction of attention causes 'a small contraction of certain voluntary muscles' involved in the process of respiration (*op. cit.* p. 72). Shepard observed that 'shock or surprise' caused by noise, whistles and similar stimuli, led in one case to a temporary check in breathing ('Organic changes and feeling', *Amer. J. Psychol.* vol. XVII, p. 534, 1906). Helga Eng observed that in 'fright' there was an acceleration of respiration followed by retardation (*The Emotional Life of the Child*, pp. 162 sqq.). Skaags, using a Klaxon horn to produce 'startledness', found that the breathing rate was accelerated after a momentary check. The breathing waves became irregular immediately after the stimulus and each wave was found to be unsymmetrical ('Changes in pulse, breathing and steadiness under conditions of startledness and excited expectancy', *J. comp. Psychol.* vol. VI, p. 310, 1926). Changes in the inspiration-expiration ratio were observed by C. Landis and R. Gullette, who used the smell of ammonia and the firing of a shot as stimuli calculated to cause 'surprise' ('Studies of emotional reactions. III. Systolic blood pressure and inspiration-

Blood volume and blood pressure. It has been observed that peripheral vasoconstriction and cerebral vasodilatation occur in surprise.[1] As for blood pressure, Landis and Gullette observed that 'sudden unexpected stimulation gave the only type of vascular reaction which shows pattern. In this case there is a sharp rise followed by an immediate fall'[2]—the pattern of an inverted V.

Other expressions. Surprise probably affects the pulse-rate.[3] It is also possible that changes occur in cardiac activity,[4]

expiration ratios', *J. comp. Psychol.* vol. v, pp. 221 sqq., 1925). H. V. Gaskill observes, however, that 'the traditionally noted "choc" or gasp in surprise was totally absent' in his experiments ('The objective measurement of emotional reactions', *Genet. Psychol. Monogr.* vol. XIV, p. 272, 1933). The mild nature of the stimulus employed by him [he made the subject read a story 'with an abrupt and surprising ending' (p. 215)] which probably caused only low intensities of surprise, and the difficulty of making observations at the exact moment of surprise in relation to the stimulus used, account for Gaskill's conclusion. The possibility may be borne in mind that even if no actual gasp were observed, a tendency to such a reaction may have existed but failed to find overt expression owing to the low intensity of the emotion aroused or due to the presence of inhibitory factors.

[1] Angell and Thomson found that every break or shift in attention caused vasoconstriction the amount of which was roughly proportional to the intensity of the emotion and the degree of surprise involved (*op. cit.* p. 69). Shepard observed a fall of arm-volume in surprise (*op. cit.* pp. 534 sq.). The results of Robbins's study showed that there was vasoconstriction 'both during stammering and emotional disturbances induced by a loud sudden stimulus', which Robbins terms 'shock'. He concluded from a review of previous studies that sensory stimuli, especially shock, which cause a break or shift of attention lead to peripheral vasoconstriction and vasodilatation in the brain ('A plethysmographic study of shock and stammering', *Amer. J. Physiol.* vol. XLVIII, pp. 290 sqq., 1919). Several of the normal subjects (non-stutterers) reported that 'the words they were about to speak left their minds' when the startling stimulus was heard 'and did not return for several seconds' (*ibid.* p. 322). The peripheral vasoconstriction and the cerebral vasodilatation in shock and stammering and their similar effects on the speech centres point to the question whether these changes are, to any extent, responsible for the inhibitory tendency in surprise.

[2] *Op. cit.* p. 251.

[3] Lehmann found that in 'alarm, shock and fright' the pulse is at first shortened but the condition is on the whole characterized by a lengthening of the pulse (*op. cit.* p. 75). Shepard concluded that there was both 'acceleration and inhibition of pulse-rate' in shock induced by an unexpected whistle (*op. cit.* pp. 553 sq.). Eng observed that in fright there was acceleration at first followed by retardation (*op. cit.* pp. 162 sqq.). Skaags found retardation in the pulse-rate in startle (*op. cit.* p. 310). There is thus no agreement on the precise effects of startle on the pulse-rate although it is clear that some disturbances do occur with that emotion. The effects of surprise, unmixed with fear, have not been investigated.

[4] Blatz found marked changes in cardiac activity when the subject was suddenly precipitated (*op. cit.*), while Landis and Slight found that 'surprise' stimulation by an unexpected loud noise caused a variety of changes in cardiac activity leading to an alteration of the P-T/T-P ratio ('Studies in emotional reactions. VI. Cardiac responses', *J. gen. Psychol.* vol. II, pp. 413–18, 1929). Blatz's observations that information regarding a stimulus reduces its effects and that the unexpected repetition of the same stimulus produces effects which resemble those of the initial presentation, afford some indirect evidence of the enhancive effects of surprise on organic changes connected with fear.

muscular tonus,[1] gastro-intestinal tonus,[2] metabolic rate[3] and steadiness.[4]

The foregoing indications regarding the expressions of surprise must be treated with considerable caution. The inadequacy of the distinction between surprise and other emotions like fear, and the lack of precision in the observation of the immediate effects of surprise, must be particularly borne in mind in evaluating the validity of the results in connexion with surprise.

Teleology and surprise

Explanations have been given from the point of view of teleological biology for surprise and for some of its expressions.

Surprise is stated to be conducive to self-preservation. Darwin thought that the eyebrows are raised and the eyes are opened in surprise in order to perceive the cause of the emotion as quickly as

[1] E. Duffy observed that in a number of her subjects muscle tension was increased when a Klaxon horn was unexpectedly sounded as a stimulus ('Tensions and emotional factors in reaction', *Genet. Psychol. Monogr.* vol. VII, 1930). In this connexion may be observed the report of kinaesthetic sensations in relation to surprise by one of Phelan's subjects (*op. cit.* p. 61) as also the frequent report of such sensations in Patterson's investigation (*op. cit.* p. 102). From his experiment on the effects of a sudden unexpected stimulus in relation to muscular tonus, E. Jacobson concluded that both sensory and motor responses are dependent upon 'the preceding general state of muscular tonus', and that even the 'feeling of shock' is absent or weak 'where the individual is extremely relaxed' ('Response to a sudden unexpected stimulus', *J. exp. Psychol.* pp. 19–25, 1926). This conclusion cannot be reconciled with some experiences, e.g. the startle sometimes experienced when one is about to fall asleep (cf. Valentine, C. W., 'The innate basis of fear', *Ped. Sem.* vol. XXXVII, p. 417, 1930) or when one wakes up with a start. In both these cases marked shock is experienced even though the body is extremely relaxed.

[2] Brunswick recorded tonus changes of stomach and rectum, using a pistol, unexpected dashing of water in the subject's face, and an electric shock, as stimuli ('The effects of emotional stimuli on the gastro-intestinal tone. I and II', *J. comp. Psychol.* pp. 19–79 and pp. 225–87). He found that the gastro-intestinal tonus was usually increased in surprise and startle (*ibid.* II, pp. 74 sqq.).

[3] Landis observed that shock leads to a decreased metabolic rate ('Studies of emotional reactions. IV. Metabolic rate', *Amer. J. Physiol.* vol. LXXIV, p. 191, 1925). In a later study he reiterates the conclusion that 'surprise is the only clearly distinguishable emotion' from the point of view of changes in the metabolic rate ('Studies of emotional reactions. V. Severe emotional upset', *J. comp. Psychol.* vol. VI, p. 238, 1926).

[4] Skaags found no detrimental effect on steadiness during the period following startle (*op. cit.* p. 310). But W. Kellog, who gave four unexpected shock stimuli, observed unsteadiness following the stimulation. The stimuli used were (i) precipitation of the chair in which S was sitting. (ii) Placing a live snake in S's lap. (iii) Asking S to slice a live albino mouse in two and (iv) requiring S 'to handle bloody calves' brains' and at the same time giving him an unexpected electric shock. All subjects reported surprise or startle and slightly more than half of them (22 out of 40) tended to be unsteady ('The effect of emotional excitement upon muscular steadiness', *J. exp. Psychol.*, vol. XV, pp. 156 sqq., 1932).

possible.[1] The opening of the mouth is 'for a deep and full inspiration' in preparation for any great exertion that may have to be undertaken.[2] Sully says that the momentary shock of surprise and the intensified attention which follows, stimulate mental activity and lead on to self-adjustment and relief.[3] Stanley Hall speaks of 'the dread of shock and surprise' as 'a fundamental instinct of physical and especially psychic preservation'.[4] He thinks that 'the spur to curiosity and enterprise' and 'the tedium of wont and routine' have their genetic root in the ambivalence towards shock, the two attitudes predominating alternately, leading to the seeking of shock as well as its avoidance.[5]

Surprise and pathology

There are indications that surprise might have an important role in the genesis of pathological states. Stanley Hall, who regards shock as a 'rupture of continuity', frequently refers to surprise and startle as if they were identical with, or at any rate closely related to, shock.[6] As was seen above, he regards 'the dread of shock and surprise' as a fundamental instinct. The morbid form of this instinct he calls 'Hormephobia'.[7] Hall thinks that shock may cause insanity, morbid complexes, phobias, obsessions, schizophrenia, and persistent changes in moral character, or lead to sexual perversions and 'about every type of arrest'.[8] He points out that 'modern psychiatry is coming to assign to shock the chief role in nearly all psychoses and neuroses'.[9] In view of the fact that the term 'shock' is used in various connexions (e.g. surgical shock, traumatic shock, shell-shock and psychic shock), it is necessary to determine the precise meaning of the term and its relationship to surprise before the extent of the influence of surprise in the causation of pathological states, spoken of by Hall, can be ascertained. However, it seems that this influence is of considerable importance. Freud has regarded 'the element of surprise' in fright

[1] Darwin, *The Expression of Emotions*, p. 296.

[2] *Ibid.* p. 299. Darwin further states that the purpose of the immobility in fright is to escape observation (*ibid.* p. 306).

[3] Sully, *The Human Mind*, vol. II, pp. 125 sq.

[4] 'A study of fears', p. 197.

[5] 'A synthetic, genetic study of fear', p. 181. It is probable that the exclamatory tendency in surprise serves a communicative function which may be conducive to the preservation not merely of the individual himself but also of other members of the group. The exclamation probably draws the attention of the members of the group to the surprising, and perhaps potentially dangerous, object and thus gives them time for preparation.

[6] 'A study of fears' and 'A synthetic, genetic study of fear'.

[7] 'A study of fears', p. 197.

[8] 'A synthetic, genetic study of fear', p. 161.

[9] *Ibid.* p. 185.

as the 'chief causal factor' in traumatic neuroses.[1] The effect of fright is responsible for 'many, if not all, cases of hysteria'.[2]

Surprise is also believed to possess considerable therapeutic value. Mott found surprise 'an essential element' in restoring the function of the vocal mechanism in cases induced by shell-shock,[3] while Reik attaches paramount importance to surprise in psychoanalysis, considering it as the essence of the analytical procedure.[4] 'The peculiar nature of the mental perturbation that is the specific mark of analysis', is essentially of the character of surprise.[5] Reik says that 'in analytic practice those acts of recognition will prove most efficacious which possess this quality of surprise'.[6]

Surprise and memory

There is some indication that the surprising event may be easily remembered.[7] This might be due to the heightened attention paid to it. But whereas the memory-value of the surprising event itself might be enhanced by virtue of its surprising character, that of the experience which immediately precedes surprise is supposed to be diminished, because of the effect of surprise on attention which is diverted to and fully focused on the surprising event.[8]

[1] Freud, S., *Beyond the Pleasure Principle*, p. 9.

[2] *Papers on Hysteria and other Psychoneuroses*, p. 3.

[3] Mott, F. W., 'The psychic mechanism of the voice in relation to the emotions', *Brit. med. J.* pp. 845 sq., Dec. 1915.

[4] Reik, Theodor, 'New ways in psycho-analytic technique', *Int. J. Psycho-anal.* 1933, and *Surprise and the Psycho-Analyst.*

[5] *Surprise and the Psycho-Analyst*, p. 51. [6] *Ibid.* p. 52.

[7] Malebranche refers to the surprising event making a marked impression so 'that the Soul may consider and know it again' (*op. cit.* p. 55). In this connexion may be mentioned the experiment by Wilcocks who found that there is 'a markedly increased memory effect for a heterogeneous content unexpectedly introduced among a group of otherwise homogeneous contents' (*op. cit.* p. 280).

[8] Shand, *Foundations*, p. 431. An interesting point may be raised in this connexion. Since surprise is regarded as a psychic shock, can it be that at least in some of its forms it conduces to 'active' forgetting of the whole experience connected with it and not merely to the passive forgetting of the experience which precedes it? (cf. the active forgetting in relation to painful experiences dealt with by W. H. R. Rivers in *Instinct and the Unconscious*).

Surprise in social psychology

The Stoics and some subsequent philosophers looked at surprise from the ethical point of view and advocated its avoidance.[1] This condemnation of surprise still persists to some extent. It seems to have been based on the association of surprise with fear and a state of lack of adaptation (implying a lack of intelligence, at least during the surprised state).[2]

Hume gave an indication regarding the connexion of surprise with the self-feelings. It has been noticed above that according to Hume a person experiences pride when he surprises others by his extraordinariness.[3]

Malebranche refers to the sympathetic induction of surprise,[4] while Dumas thinks that the facial expression of surprise is easily imitated and utilized in social intercourse.[5] Dearborn found that the expression of surprise might be inhibited by politeness and pride.[6]

The importance of surprise in relation to various experiences and activities of social significance has been indicated. It seems to be of some importance in relation to laughter, wit, jokes and play and in the appreciation of literature, drama, art and poetry.[7]

Individual differences in amenability to surprise

The possibility of differences in the emotional make-up of individuals[8] leads to the speculation whether differences are to be found in the

[1] Cicero, *op. cit.* p. 263; cf. Marcus Aurelius (Long, George, *The Thoughts of the Emperor Marcus Aurelius Antoninus*, pp. 185 sq.); Gregory of Nyssa (Moore and Wilson, *Select Writings of Gregory of Nyssa*, p. 443); Malebranche, *op. cit.* vol. II, p. 72; La Rochefoucauld, *Moral Maxims*, p. 73.

[2] Cf. in this connexion Dryden's couplet:

> The fool of nature stood with stupid eyes
> And gaping mouth, that testify'd surprise

('Cymon and Iphigena' in *The Poems of John Dryden*, Oxford ed., p. 362, 1910).

[3] In this connexion may be mentioned the importance of simulated surprise in inducing a positive self-feeling in others.

[4] *Op. cit.* vol. II, p. 104.

[5] *Nouveau Traité de Psychologie*, vol. III, pp. 119 sq.

[6] Dearborn, G. V., 'The emotion of joy', *Psychol. Rev. Monogr.* p. 18, 1894.

[7] References to the relationship of surprise and these experiences and activities were noticed in connexion with the section on surprise and its affinities.

[8] E.g. Seneca referred to 'differences in the reactions of the passions based on age and sex' (Seneca, *De Ira*, quotation from Janet and Sèailles, *A History of the Problems of Philosophy*, vol. I, p. 268). Montaigne spoke of his own anger as 'sharp but withal short-lived' (*The Essays of Michael de Montaigne*, vol. II, p. 447), while J. S. Mill spoke of men who are 'naturally pugnacious or irascible, or enthusiastic' (*Three Essays on Religion*, p. 105). Recently Cyril Burt has suggested that there is a general factor governing an individual's emotional capacities (*The Young Delinquent*, pp. 506 sqq., and *The Subnormal Mind*, p. 51). It is a question whether there is a specific factor for each emotion which determines the frequency, duration and intensity of its occurrence.

capacities of individuals to experience surprise. Such differences are referred to by Lotze and Hiram Stanley.[1] Variations in the capacity to experience surprise, based on age, are mentioned by McCosh[2] and Hiram Stanley,[3] who think that infants are particularly susceptible to experience surprise, and by Thomas Brown who holds the opposite view, asserting that the infant is incapable of surprise.[4]

This problem, and a number of others which have been observed during the historical survey, await experimental research.

[1] Says Lotze: 'Great variety of impressions, the shock of surprise, the constant tension due to uniform mood or orderly sequence of ideas, any of these may be to the temperament of one a necessity, to that of another a torture' (Lotze, Hermann, *Microcosmus*, trans. Hamilton and Jones, vol. I, p. 699, 1885). Stanley asserts that 'the man of large resources, cautious nature and keen insight and foresight, is little liable to be surprised, for in all circumstances he accurately forecasts a very wide range of possibilities' (Stanley, Hiram, *op. cit.* pp. 164 sq.).

[2] *Op. cit.* p. 137.

[3] *Evolutionary Psychology of Feeling*, p. 173.

[4] *Op. cit.* p. 345.

PART II. EXPERIMENTAL

CHAPTER I

THE PROBLEMS, THE METHOD AND THE SUBJECTS

During the historical survey a number of problems connected with surprise have emerged. In what follows an attempt has been made to deal with some of them. Attention was mainly directed to the following problems:

(*a*) The effect of surprise on the activity in which the individual experiencing surprise is engaged at the moment of the experience.

(*b*) The effect of surprise on the emotions associated with it.

(*c*) The relationship of surprise to expectation.

(*d*) The relationship of surprise to laughter.

But although these problems were the special concern of the investigator, the experiments were calculated to yield data bearing on other problems as well.

Method

In the main, the introspective approach was employed, but objective measurements were also obtained in some experiments. Reliance was placed primarily on the impression method, but the expression method was not altogether neglected, the p.g.r.[1] having been employed as a subsidiary mode of investigation in two of the experiments.

Although it is probably true that 'psychologists have identified this electrical reaction with almost every conceivable mental process, and with only the most questionable evidence to back their claim',[2] yet the fact remains that the p.g.r. *is* sometimes correlated with experiences which are predominantly of an emotional nature and that compared with other modes of measuring the physiological concomitants of emotion used in the expression method, the response has 'on the whole, shown itself most fruitful in results'.[3] These considerations would be sufficient justification for the employment of the p.g.r. technique in the investigation of emotional reactions.

[1] This symbol is used to represent the words 'psycho-galvanic response'.

[2] Landis, Carney, 'Emotion. II. The expressions of emotion', in *The Foundations of Experimental Psychology*, p. 513.

[3] Flügel, J. C., art. 'Feeling', *Encycl. Brit.* 14th ed.

But in the case of surprise especially the possibilities of the technique seem to be somewhat more promising than in connexion with other experiences, since some investigators have found that shock, startle, 'choc', or similar experiences are particularly related to the p.g.r.[1]

The method of obtaining the p.g.r. records was determined principally on the grounds of convenience. A photogalvanograph, similar to that used by Wechsler,[2] was employed. The Wheatstone Bridge circuit used by Wechsler was dispensed with because it would have demanded almost incessant attention on the part of E. Godefroy's[3] circuit was adopted, a transformer having been introduced in the circuit. Wet batteries of the strength of 8 V. were used, and to avoid the possibility of a shock being experienced by S a potentiometer was introduced in the circuit to regulate the flow of the current.

The electrodes adopted were the relatively non-polarizable calomel electrodes of the same type as Bayley's.[4] These were composed of mercury, mercurous chloride and a 2 % solution of sodium chloride, in two glass tubes. The tubes were fitted in a portable hand-rest which enabled E to shift the position of the electrodes when left-handed Ss observed in experiments which necessitated the use of their hands for reactions.

The contact was effected by the subject dipping, in two tubes, his index and ring fingers up to about two digits. In order that the surface of the fingers exposed to the current should remain constant, each finger was insulated above the first digit by the use of an insulating tape. The fingers were thoroughly cleaned with surgical spirit before their introduction in the circuit.

Choice of stimuli and subjects

It has been observed that, in a number of experiments, by different authors, where an element of surprise has been aroused, the stimuli used were very often of such a nature that fear, in some form, or other strong emotion tended to be aroused. In at least some of the experi-

[1] Seen in Part I.

[2] Wechsler, David, 'Measurement of emotional reactions', *Arch. Psychol.* 1925. Thanks of the writer are due to Mr J. T. Raper who constructed the instrument according to specifications.

[3] Given in Thouless, R. H., 'The technique of experimentation on the psycho-galvanic phenomenon and the phenomenon of Tarchanoff. I', *Brit. J. Psychol.* vol. xx, p. 229 and pp. 237 sq., 1930.

[4] Bayley, Nancy, 'A study of fear by means of the psychogalvanic technique', *Psychol. Rev. Monogr.* vol. xxxviii, pp. 1–38, 1928.

ments, therefore, an attempt was made to eliminate the interference of any strong emotion, as far as possible, by the choice of suitable stimuli. It was desired to obtain surprise in as unmixed a form as possible although the extreme difficulties of attaining this object were fully realized.

A considerable number and variety of subjects had to be drawn upon since the very nature of the investigation made it impossible to utilize the same subject over and over again for different experiments. S could infer the nature of the problem being investigated when he had observed in two experiments, and even if he failed to do so, E had to impart the information himself since he had to request S at the conclusion of his sitting not to divulge the specific nature of the experiments to other students who might be required to observe as subjects. S was provided with an adequate answer to possible questions, such that the curiosity of the prospective S might be satisfied without his knowing that the experiments were calculated to study surprise.

The number of trained introspectors being very limited, a large number of the Ss had little or no training in introspection under experimental conditions. The few Ss who had such training were reserved for experiments which required detailed and very accurate introspection. Owing to this difficulty with regard to Ss, E was compelled to employ a smaller number of Ss for each experiment than he desired. In none of the experiments could he employ more than twenty-four Ss. In most of the experiments, however, the number of Ss used afforded adequate data.

The necessity of employing untrained Ss made it necessary to devise a means of obtaining the most relevant information from S regarding his reactions to the stimulus. Since introspections on the emotional reactions in particular were required, a uniformly typewritten list of feelings and emotions was drawn up comprising a number of different feelings and emotions, arranged in nine groups, each of which contained feelings and emotions of a similar nature. The group in which surprise appeared was placed in an inconspicuous position in order to avoid the possibility of suggestion or contra-suggestion being induced. This list was given to S after he had finished his introspective report. To minimize the possibility of suggestion he was first to read the whole list through. He was then to inform E if he experienced any feeling or emotion during the course of the experiment. If he experienced a feeling or emotion but could

not name it exactly, he could indicate the group within which it fell or he could describe it in his own terms.

This list appears to possess considerable utility since it eliminates the difficulty of untrained introspectors to find names for familiar experiences and it substitutes the easier process of recognition for the more difficult process of recall. Its utility is particularly enhanced in experiments of a nature where the experience on which introspections are especially desired is difficult to introspect because of its short duration, its liability to be swamped by other experiences, the unpreparedness of S for the experience, and, perhaps, the possibility that the coming into awareness of the experience may be interfered with by inhibitive factors connected with the social valuations placed on the desirability of being well-poised or the undesirability of being thrown off one's balance.

CHAPTER II

THE GENERAL SET-UP AND THE EXPERIMENTS

All the experiments, except the seventh, were conducted in a room which remained almost dark unless electrically lighted.

On a table placed lengthwise against a wall, a tachistoscope was adjusted behind which the recording and other apparatus were arranged. The apparatuses were thus screened off from S by the tachistoscope. A kymograph fitted with a triple time-marker was fixed on the table about 6 in. from the wall. A vibrator was connected with the triple time-marker to give time in $\frac{1}{10}$ sec. A shaded table lamp was placed on the right-hand side of S,[1] while the hand-rest containing the electrodes was generally arranged on the left-hand side, the position of these being reversed when S was left-handed.

A key for the use of S was fastened with a strap on the table.[2]

The photogalvanograph was adjusted in a corner.

The experiments

Altogether seven experiments were carried out. Of these the first three were calculated to throw some light on the conative tendency of surprise, if any; the fourth was devised to investigate if surprise has an intensifying effect on the emotions associated with it; the fifth and the sixth were meant to clarify the relationship of surprise with expectation and laughter respectively; while the seventh experiment was a comprehensive one the data from which were expected to yield knowledge regarding a number of problems connected with surprise.

Experiment I. 'Cards and animals'

The specific purpose of this experiment was to determine the effect of surprise on the activity in which the subject is engaged at the moment of surprise.

[1] The overhead light was not used in the first two experiments.

[2] This key will be referred to as the response key while the key used by E for giving the stimulus will be referred to as the stimulus key.

This was a reaction-time experiment in which the subject was to respond to visual stimuli given through tachistoscopic exposures.

The idea was first to establish a set in the subject by giving him stimuli of one type and then to change over to stimuli of a totally different type, the first of which was calculated to arouse surprise. By comparing the reaction-time for the surprising stimulus with the reaction-times for other stimuli of the same class, it was hoped to ascertain the effect of surprise on the activity of the subject at the moment of surprise.

The stimuli comprised a series of eight unit numbers printed on cards followed by a series of five rubber toy animals. The animals used were an elephant, a lion, a dog, a donkey and a fish.

The p.g.r. technique was used in this experiment to determine if surprise evoked under the conditions of this experiment is connected with the response.

Procedure.

S was informed that a current of a very low voltage would be passed through him. He was assured that he would not experience any electric shock whatever. To mitigate anxiety, as soon as he was introduced into the circuit he was informed about it. S was then given the necessary instructions.

He was told that something would be shown to him through the aperture in the screen. He was to react by pressing the response key as soon as he had recognized what was shown. E would say 'Ready' just before opening the shutter. At that signal S should look at the aperture and be prepared to react. When the shutter was opened, S was to react *as quickly as he could but not before he had recognized what was shown.* The last phrase was emphasized. S was also to inform E if by accident he pressed the key before recognition of the stimulus. Thus it was ensured that S did not react to the auditory stimulus of the signal or to the sound made by the key or the shutter of the tachistoscope.

The stimuli were then given and immediately afterwards the introspections of S were recorded. After S had said what he had to say, the list of feelings and emotions, previously mentioned, was given and further introspections were recorded.

During the course of the experiment E observed reactions on the part of S such as laughter, exclamations, utterances, etc.

Twenty-four Ss observed.

The time of the stimulus was simultaneously recorded on the kymograph and on the tachogram by means of two keys, the tachogram key[1] and the stimulus key, which were pressed simultaneously by E.

Experiment II. 'Tapping and light'

The purpose of this experiment was to study the immediate effect of surprise on a measurable activity in which S is engaged at the moment of surprise.

The activity consisted of continuous tapping on a key, at a steady but fast rate, for nine periods of about 5 sec. each, with intervals of about 10 sec. each between the tapping periods. It was desired to know if surprise caused any stoppage in the tapping.

The stimulus, which was introduced in the fifth and the succeeding tapping periods, consisted of switching off the light at about 1·5 sec. after S commenced tapping. The stimulus was calculated to arouse surprise during the fifth tapping period when it was introduced for the first time. The other tapping periods, the first four during which no stimulus was given and the last four during which the stimulus was given as in the fifth, were meant to be control periods.

The tapping was to be carried on without looking at the key since, in view of the nature of the stimulus, E desired to avoid the complications that may be introduced in the activity by visual factors.

Before commencing the experiment proper, a varying number of practice periods was given till S attained a high degree of speed and steadiness.

Kymographic records of the tapping and the time of the stimulus were obtained. In order to switch off the light a key, introduced into the circuit which supplied the current to the table lamp, was pressed. This key (to be referred to as the lamp key) was pressed simultaneously with the stimulus key in order to get a record of the exact time when the stimulus was given.

Introspections were obtained after the last tapping period in the same manner as in the first experiment.

Twenty Ss observed.

[1] The key which indicated the time of the stimulus on the tachogram by breaking the circuit for a moment.

Experiment III. 'Verbal addition'

The purpose of this experiment was the same as that of the first two experiments, viz. to induce a strong conative set in S towards a certain kind of reaction and then to observe the effect of surprise on the reaction.

Like the first experiment this was a reaction-time experiment. S was given a number through tachistoscopic exposure and was asked to add 3 to it and say the total aloud as quickly as he could.

Nine one-figure numbers and six two-figure numbers of uniform size, printed on cards, were used. First, eight one-figure numbers were given and then the larger numbers followed. '1' was given as the last number. It was hoped that the first large number following on small numbers, and perhaps, to a lesser extent, '1' following on the large numbers, might cause surprise.

It was desired to measure the interval between the time of the stimulus and the time when S commenced giving the verbal response. The quickness with which S commenced the verbal reaction, and not the correctness of the response, was the material point.

Some means had to be devised to record the time of the commencement of the response. The lip key suggested itself for this purpose but was rejected because it would have meant a dissipation of S's conative energy and would have necessitated prolonged practice for its efficient use, while some possibility of errors caused by accidental release would have been always present. Further, the reaction may have been involuntarily anticipated owing to the tendency of the jaw to drop in surprise. Some other method of recording S's reactions, therefore, had to be devised.

According to the method adopted E himself worked both the stimulus key and the response key. The possible magnitude of the normal variations in E's own reactions for auditory stimuli under the conditions of the experiment was determined and allowance was made for the variations when considering the results.

The numbers given were: 3, 7, 6, 4, 8, 2, 9, 5, 67, 48, 56, 39, 25, 72, and 1. The first three were regarded as practice stimuli.

Twenty-three Ss observed.

Experiment IV. 'Masks'

The purpose of this experiment was to determine the effect of surprise on the intensity of the emotion or emotions which came with it or immediately followed it.

The problem was attacked from two directions and both the impression and expression methods were employed, the p.g.r. technique being used for the latter.

Six pictures, calculated to arouse similar emotions, were chosen as stimuli. These were coloured pictures of Singalese masks.[1]

It was thought that by obtaining values for the degree of emotion aroused by each of these stimuli and comparing them with each other it may be determined whether those emotions which came with or immediately after surprise tended to possess greater intensity than others which were not associated with surprise.

Procedure.

After S was introduced into the circuit he was instructed as follows:

'Pictures will be shown to you through this aperture in the screen. When I say "Ready" I want you to look at the aperture. Then the shutter will be opened and you will see a picture. I want you to keep on looking at that picture till the shutter is closed again. Note carefully what passes through your mind while you are looking at the picture and particularly observe your emotional reactions as I shall require your introspections.'

The opening and closing of the shutter was then demonstrated to S so that his reactions might not be affected by the way the shutter opened or by the background when the first mask was shown.

Each mask was shown for 5 sec., the time being determined by a stop-watch which was kept running while E pressed the requisite keys.

Since E's eyes were focused on the watch, he could not observe S during his reaction, but any exclamations or laughter or words uttered were noted.

After each mask full introspections were recorded, a list of feelings and emotions, similar to, but more comprehensive than the one employed in other experiments being used. When S had given the emotions he experienced he was asked to name the order of their occurrence. Values for the intensity of each emotion were obtained on a scale of 1–10. After he had valued the first emotion, S was requested to keep the same standard of valuation in mind while valuing other emotions, whether in connexion with the same mask or different masks. To ensure that this request was carried out, non-suggestive questions were asked or statements made, from time to

[1] Obtained from the British Museum.

time. These consisted merely of a reiteration of the values given by S (e.g. if S valued 'dislike' for one mask at 5 and the same emotion for the next mask at 6, E would say 'slightly more dislike for this than the last one').

The same procedure was followed in connexion with each of the stimuli.

Twenty Ss, with varying degrees of training in introspection, observed.

Experiment V. 'Expectation'

The main purpose of this experiment was to study the relationship between expectation and surprise. Some secondary aims were, however, kept in mind and observations were made in view of those aims.

The experiment was carried out immediately after the experiment 'Verbal Addition'. The stimulus was given when S had finished giving his introspections on the latter experiment. While S looked at E, the latter raised his hand to the level of his own face to bring it within the centre of S's visual field and quickly snapped his fingers. The hand was kept in the same position for two or three seconds with the index finger straight in front of E's eyes. E kept at least a yard away from S when giving the stimulus, so that the possibility of causing fright or similar emotions might be avoided.

S's reactions, e.g. exclamations, utterances or laughter, were recorded and he was asked to give his introspections.

When S had said what he had to say, he was asked his introspections regarding his expectation at the moment just preceding the stimulus. He was asked to evaluate it on a scale of 0–10 in terms of the definiteness of the contents of his expectation (i.e. what he expected) the degree of certainty of the expectation, and the degree to which he was conscious of the expectation.

Ten Ss observed, all of whom possessed some training in introspection.

Experiment VI. 'Jokes'

The purpose of this experiment was to investigate the relationship between surprise and laughter. The subsidiary aim was to obtain data regarding amusement and expectation.

Eight small cards were used on six of which jokes were typewritten. In each of these, a part of a joke was typewritten on one side of the card while the remainder was on the other side. Thus S had to turn over the card in order to read the complete joke. In the seventh

card a joke was left incomplete on one side while the other side contained a small square and the letter 'A'. The last card had also a part of a joke on one side but the other side was left blank. In the sixth card the joke began with a sentence which seemed a scientific statement but was completed on the other side of the card by two short words. The seventh card was calculated to cause surprise to a marked degree, while there was a possibility that the eighth card and even the sixth might cause some surprise.

The material on both sides of each of the cards is given below:

First side	Second side
Card I.	
Customer: 'Can you guarantee this anti-wrinkle cream?' Chemist: 'Madam, it would	smooth out corrugated-iron.'
Card II.	
'I told Jim all my past history yesterday.' 'What did he say?' 'Oh, nothing. He just	took out a comb and smoothed his hair down.'
Card III.	
A man was fumbling at his key-hole in the small hours of the morning. A policeman saw his difficulty and came to the rescue.	'Can I help you to find the key-hole, Sir?' he asked. 'Thash all right, old man,' said the other cheerily. 'You just hold the house still, and I can manage.'
Card IV.	
An Irishman was relating his adventures in the jungle. 'Ammunition, food and whisky had run out,' he said, 'and we were parched with thirst.'	'But wasn't there any water?' 'Sure, but it was no time to be thinking of cleanliness.'
Card V.	
Cuthbert was trying to impress the party with details of a thrilling experience. 'Then,' he cried dramatically, 'the burglar threatened	to blow my brains out.' 'And did he?' asked a listener.
Card VI.	
The only functionless thing in the whole of the human organism is the appendix and, in some cases	the brain.
Card VII.	
A boastful American was holding forth on the merits of his watch to a number of uninterested clubmen. At last one of the men decided he could stand it	□ A
Card VIII.	
Friend: 'Your girl came up and said she wouldn't be able to meet you to-day.'	

The other side in Card VIII was left blank.[1]

E observed the reactions of S and noted any smile or laughter on a scale which consisted of the following rough classifications: slight smile, smile, broad smile, slight laughter, considerable laughter, profuse laughter. E based his judgement on both the intensity and the duration of the reaction.

After each card was read, S's introspections were taken down and he was asked to estimate the degree of amusement experienced and the degree of expectation on a scale of 0–10. The same procedure was followed for all the cards. After this the cards were arranged in front of S in the order in which they were presented and S was asked to arrange them in order of their value for surprise, if any, which each card evoked in S when he read it. He was told that if one or more cards had failed to cause surprise they might be placed last. After S had arranged the cards in the order desired, he was asked to estimate their values for surprise on a scale of 0–10.

Twenty-one Ss, with varying degrees of training in introspection, observed.

Experiment VII. 'Introspections'

The purpose of this experiment was to see what light the introspections of trained introspectors throw on the nature of surprise and on some of the problems connected with it.

The studies of Flügel and Stratton supplied the cue to this experiment. Flügel[2] carried out an intensive study of feelings and emotions, asking his subjects to observe their emotional and feeling experiences over a given period of time. Stratton[3] gave his subjects a list of situations calculated to arouse anger or fear, and asked them to record their reactions when situations of the type given in the list occurred. The great advantage of a technique similar to those employed by Flügel and Stratton is that it gives the reactions of the individual under situations of ordinary everyday life when the attitude of the subject is not permeated by a laboratory atmosphere.

Fourteen trained introspectors were asked to introspect and record their experiences and reactions whenever they experienced surprise.

Partly with a view to facilitate introspection so that it might be as

[1] All jokes except VI were taken from *Tit-Bits* and *The Humourist*, to the editors of which the writer begs to make his acknowledgements with thanks.

[2] Flügel, J. C., 'Feelings and emotions in everyday life', *Brit. J. Psychol.* 1925.

[3] Stratton, G. M., 'Anger and fear: their probable relation to each other, to intellectual work, and to primogeniture', *Amer. J. Psychol.* vol. XXXIX, pp. 130 sqq., 1927.

complete as possible, and partly with a view to emphasize certain points on which information was particularly desired, a sheet of instructions was issued to each S. The following is a copy of the instructions:

Information is required on the following points in particular, but anything which you think to be relevant or likely to be useful may be written down.

Your introspections are required on:

(1) The nature of the experience of surprise together with the mental contents before, during and after the experience.

(2) The object or situation which caused surprise.

(3) The nature of the motor reactions at the moment of the experience and immediately afterwards.

(4) What were your conscious expectations immediately before the experience of surprise?

Please state them in terms of their definiteness and certainty, i.e. *what* you expected and with *what degree of certainty* you expected.

Rate

(i) the degree of consciousness of the expectation,

(ii) the definiteness of the expectation,

(iii) the degree of certainty of the expectation,

(iv) the degree of surprise,

on a scale of 0–10.

(5) What emotion or feeling, if any, preceded, accompanied or/and followed surprise?

In your opinion, was the intensity of the emotion which accompanied or followed surprise increased or diminished by surprise, or did it remain unaffected?

Record your introspections as soon after the experience as possible. In any case note (approximately) the time of occurrence of the experience and the time when you commence writing down.

When giving the sheet, any explanations required by S were given.

A small booklet which could be conveniently carried in a pocket was given to each S.

Eight Ss returned the booklets with the number of introspections ranging from 1 to 7.

In the following pages the data obtained from the experiments will be dealt with.

CHAPTER III

THE INHIBITORY EFFECT OF SURPRISE

A NUMBER of philosophers and psychologists have observed the inhibitory effect of surprise on the activity in which the individual is engaged at the moment of the experience.[1] There has been, however, no adequate experimental investigation in this connexion.

Three experiments were devised with the specific purpose of investigating this problem, and in one more (Exp. VII) information was obtained regarding the effect of surprise on the activity of the subject.

In the first three experiments quantitative data were obtained, although the aim was not to procure any exact quantitative measure but rather to see if any general tendency is indicated by the objective results. From Exp. VII some valuable introspective data were derived.

As seen in the preceding Chapter, in Exp. I the subject was asked to react to an object shown as soon as he had recognized the object.

The results of the experiment are given below in Table I.

The results of twenty Ss out of twenty-four have been tabulated.

Table I

Subjects	1st animal	2nd animal	3rd animal	4th animal	5th animal	Percentage excess in *R-T* for 1st animal
RN	1·95	0·45	0·45	0·4	0·5	290
KM	0·7	0·4	0·5	0·5	0·5	40
PH	0·6	0·3	0·35	0·35	0·35	71
FE	0·7	0·2	0·2	0·2	0·3	133
CA	0·4	0·3	0·2	0·2	0·3	33
GA	0·8	0·55	0·45	0·4	0·4	45
MC	0·5	0·25	0·3	0·2	0·35	43
BW	0·4	0·25	0·3	0·35	0·35	14
MR	0·75	0·35	0·2	0·3	0·35	114
HT	0·8	0·35	0·35	0·4	0·3	100
DS	0·35	0·25	0·3	0·3	0·45	−28
BR	0·35	0·2	0·2	0·2	0·2	75
DK	0·5	0·3	0·35	0·35	0·25	43
CL	0·5	0·3	0·3	0·25	0·3	66
DZ	0·8	0·7	0·65	0·65	0·6	14
WT	0·8	0·35	0·3	0·35	0·35	128
HL	0·85	0·4	0·4	0·4	0·45	89
LE	0·55	0·55	0·45	0·35	0·4	0
CV	0·65	0·4	0·45	0·4	0·35	44
AB	0·55	0·4	0·4	0·4	0·35	37

R-T values to the nearest $\frac{1}{20}$ sec.

Percentage excess in *R-T* for 1st animal represents excess over the highest *R-T* for the rest.

[1] See Part I.

The records of the remaining four Ss were considered unreliable owing to their failure to follow instructions properly. An examination of their reactions showed values as low as 0·05 and sometimes 0. Even negative values were observed. Probably these Ss reacted automatically to an auditory stimulus such as the signal 'Ready' or the noise of the key.

The reactions for 'Cards' are not given as they are irrelevant, the cards being meant to establish a certain set in E. Besides, the reactions for 'Cards' cannot be compared with those for 'Animals' owing to the difference in the nature of the stimuli. It may, however, be stated that the former were slightly lower than the latter.

All Ss, without a single exception, reported surprise for the first animal. Surprise was not reported for any of the succeeding animals, but one S (FE) reported slight startle for fish.

The excesses in reactions for the first animal are given in terms of percentages because absolute differences would not indicate the disparity in reactions adequately.

The differences in the reactions for the first animal as compared with the highest among the reactions for subsequent animals may be summarized as follows:

In five Ss there was an excess of 100 % or over; in four, 50 % or over; in seven, 33 % or over and in two the excess was 14 %. In one S (LE) there was neither an excess nor a diminution, while in another (DS) there was a diminution of 28 %.

Thus, in sixteen out of twenty Ss the reactions were markedly higher for the first animal which came as a surprise when compared with the reactions for other animals which failed to cause surprise. One of the two Ss (BW), in whose reactions there was an excess of only 14 %, said, 'I was surprised at the first one but I think I pressed the key before I recognized it.'

In the case of FE, who experienced a slight startle in connexion with fish, his reaction for the stimulus (0·3) is 0·1 longer than the next highest—an excess of 50 %.

Although in LE there is no excess, and in DS there is a diminution, in the reaction for the first animal as compared with the highest of the reactions for the rest, it may be pointed out that in both cases the reactions for the first animal are slower than those for all other animals except one.

To summarize, then, when S was surprised, in eighteen out of twenty Ss the reaction was lengthened; in one S it was equal to one other

reaction but longer than the rest, while in only one S was it shorter than another reaction. But even in this last case it was definitely longer than all the reactions except one.

The slowness of the reactions for the first animal which caused surprise cannot be attributed to any differences in the nature of the stimuli which could have made recognition more difficult for the first animal than for others. This possibility was guarded against by changing the order of presentation of the different stimuli, three animals—elephant, lion and dog—having been employed as the first stimulus for different groups. A comparison of the reactions for all the stimuli showed that none of the stimuli thus employed required higher reactions than others. Nor can accidental variation account for the extremely high correlation between surprise and a delay in response. It can, therefore, be rightly concluded that the impulse of the subject to react as quickly as he could was checked owing to surprise, causing the reaction-time to be lengthened.

To consider now the results of the experiment 'Tapping and Light', it may be remembered that in this experiment S was asked to go on tapping on a key as steadily and as fast as he could until he was asked to stop. He had nine 5 sec. periods of tapping, in the last five of which the light was switched off as a stimulus.

The results are given below in Table II.

Table II

Subject	N.-I.	Duration of 'break'	Percentage increase over N.-I.
AB	0·13	Nil	0
BB	0·24	0·5	108
CA	0·17	Nil	0
CG	0·14	0·5	257
CL	0·15	Nil	0
CV	0·13	0·35	169
DD	0·17	Nil	0
DS	0·12	Complete stop	—
DZ	0·2	0·35	75
GA	0·2	0·9	350
GD	0·2	0·4	100
HB	0·14	0·35	150
LE	0·13	0·2	54
MC	0·12	0·25	108
MH	0·15	0·4	166
MR	0·14	0·55	221
MS	0·25	Nil	0
PH	0·16	Complete stop	—
PR	0·18	0·5	177
WT	0·12	0·3	150

N.-I., normal interval. 'Break', an appreciable lengthening of N.-I. connected with the surprise stimulus.

The normal interval between two taps (to be termed N.-I. hereafter) was arrived at by taking five 1 sec. periods at random, one from each of the five stimulus periods,[1] and dividing the number of periods by the number of taps.

In most cases interruptions, ranging from one to four in number, occurred, but only in one case (MR) were there frequent interruptions, amounting to as many as fourteen.

If an interruption commenced within 0·6 sec. of the time of stimulation, it was regarded as connected with the stimulus. This limitation was adopted on the ground that all the interruptions connected with the stimulus in the first stimulus period occurred within 0·2 sec., that introspective reports of Ss related these interruptions with the stimulus, and further that there would be little possibility of the stoppage being connected with the stimulus if S could tap thrice after the stimulus as he would usually do within 0·6 sec. There was only one S (MR) in whose tapping a break, which may have been possibly connected with the stimulus, occurred in a period other than the first stimulus period. This break occurred at 0·8 sec. after the stimulus in the third stimulus period, and may be regarded as accidental in view of the frequent stops which occurred in the tapping of this S.

Out of the twenty Ss, sixteen reported surprise and one startle, while three did not report surprise or any other emotion.

In fifteen Ss, all of whom reported surprise, there was a break in the continuity of tapping connected with the stimulus in the first stimulus period. Out of these fifteen, two (DS and PH) stopped completely when the stimulus was given. In the remaining thirteen, the difference between N.-I. and break was 0·2 sec. or more. In eleven of these, there was an increase of 100 % or over. In DZ the increase was 75 %, while in LE it was 54 %.

Of the five Ss who had no breaks, three (AB, CA and CL) reported no surprise. CA and CL reported that they expected something of that sort to happen. It may be pointed out that these three were among the persons who acted as Ss for Exp. I as well as II at the same sitting. Hence their expectation regarding something unusual to turn up.

In one S (DD) startle was reported, but there was no break. Perhaps this was due to the reflex effects of startle which may have kept up the continuity of S's tapping by causing involuntary movements of

[1] Those periods during which the stimulus was introduced.

the finger.[1] The time taken by the one or two involuntary taps thus made may have sufficed to enable S to recover from the effect of the surprise elements of the experience, if any.

In the one S who reported surprise but had no break, his introspections indicate that he felt he had stopped. He says, 'Surprise—a bit put off—I stopped.' Perhaps he experienced a tendency to stop but found sufficient time to counteract it by his desire to persist in tapping owing to his rather long N.-I. which was 0·25—the longest of all.

As for the temporal relationship of the break to the stimulus, in four Ss the break occurred simultaneously (or within 0·025 sec.) with the stimulus, in eight Ss it commenced after, and in three apparently before, the stimulus. In the latter cases the initial part of the break—the interval between the stimulus and the preceding tap—may be ascribed to N.-I., and the interruption in the tapping may be really said to commence with the stimulus. In all cases where the break commenced after the stimulus there is one tap between the stimulus and the break. This may be explained by the assumption that the tap subsequent to the stimulus was due to the momentum of the activity. There is, therefore, the possibility that the inhibitory effects of the stimulus may be delayed by a small fraction of a second if they have to overcome a strong impulse.

The results show that in fifteen out of twenty Ss surprise was associated with a lengthening in the N.-I. between two taps, or to put it in another way, there was a slight pause or stoppage simultaneous with or immediately following surprise. Moreover, in three Ss who did not experience surprise there was no such stoppage. In one case of startle and one of surprise, where no stoppage occurred, there was a possibility that the effect of surprise, observed in other cases, may have been counteracted. It must be concluded, therefore, that surprise caused a stoppage in the activity in which S was engaged at the moment of the experience.

But in view of the fact that there are a few other pauses unconnected with the stimulus, may it not be that the breaks were merely accidental like the others due to tension, excitement, fatigue or other causes? The occurrence of the pause in very close temporal proximity to the stimulus in almost all cases where surprise was reported, and its absence from others where no surprise was evoked

[1] Cf. the involuntary flexion of fingers observed by Hunt and Landis in their film 'The startle pattern' in which reactions to startle were photographed (*Psychol. Abstr.* vol. x, no. 12, p. 638, December 1936).

precludes such a possibility. It may be, therefore, concluded that surprise has an inhibitory effect on the motor activity in which the individual is engaged at the moment of the experience.

The results of Exp. III will be examined now.

It will be recalled that in this experiment S was given a series of numbers to each one of which he had to react by adding 3. The first two-figure number following on one-figure numbers was calculated to arouse surprise; so also, to a lesser extent, '1' following on a series of two-figure numbers.

In order to avoid the possibility that the length of the reaction-time for the first two-figure number may be due to some peculiarity in the number itself, one number was used as first for ten Ss and another for the rest.

The results[1] are given below in Table III.

Table III

	Two-figure nos.				One-figure nos.			
Subject	Average reaction	Range of reactions	Reaction for first two-figure nos.	Difference between reaction for first no. and highest of reactions for others	Average reaction	Range of reactions	Reaction for '1'	Difference between reaction for '1' and highest of reactions for others
BR	1·17	1·0 –1·4	1·8 S	0·4	1·01	0·8 –1·1	1·5 S	0·4
DT	0·87	0·8 –0·95	1·05 S	0·1	0·81	0·7 –0·95	1·1	0·15
EC	0·92	0·8 –1·0	1·6 S	0·6	0·67	0·6 –0·85	1·2 S	0·35
GR	0·95	0·9 –1·0	1·45 S	0·45	0·93	0·8 –1·0	1·3 S	0·3
HF	0·79	0·65–1·0	1·9 S	0·9	0·68	0·6 –0·8	1·0 S	0·2
HP	1·1	1·0 –1·2	2·5 S	1·3	1·15	1·05–1·2	1·1	–0·1
IN	1·61	1·25–2·2	1·8 S	–0·4	1·44	1·05–2·1	1·4 S	–0·7
JS	0·99	0·9 –1·1	1·5 S	0·4	0·82	0·7 –0·9	1·1	0·2
RL	0·85	0·8 –0·95	1·85 S	0·9	0·77	0·65–0·85	0·9	0·05
SC	0·84	0·7 –1·0	1·6 S	0·6	0·77	0·65–1·0	0·9	–0·1
BC	1·06	0·8 –1·4	1·7 S	0·3	0·88	0·8 –0·95	1·3 S	0·35
BF	1·32	1·1 –1·95	2·0	0·05	0·98	0·65–1·25	1·5 S	0·25
BL	0·8	0·65–0·9	1·2 S	0·3	0·66	0·6 –0·75	0·95 S	0·2
DL	0·83	0·65–1·0	0·9	–0·1	0·74	0·6 –0·9	1·1 S	0·2
FH	0·84	0·75–0·9	1·05	0·15	0·81	0·75–0·9	0·95	0·05
GB	0·76	0·7 –0·8	1·2 S	0·4	0·81	0·65–0·9	0·9	0
MG	0·68	0·7 –1·25	2·65 S	1·4	0·78	0·6 –1·0	1·1	0·1
MM	0·83	0·7 –1·05	1·5 S	0·45	0·77	0·6 –0·95	1·05	0·1
PL	0·84	0·6 –1·1	1·6 S	0·5	0·78	0·7 –0·95	1·05	0·1
SL	1·02	0·9 –1·2	1·6 S	0·4	0·79	0·7 –0·9	1·0	0·1
SR	1·13	0·85–1·4	1·2	–0·2	0·8	0·65–0·9	1·0	0·1
SW	0·91	0·8 –1·2	1·7 S	0·5	0·82	0·7 –0·9	0·9	0
TH	0·76	0·6 –0·9	1·65 S	0·75	0·81	0·7 –0·9	1·35 S	0·45

Reaction-time values to the nearest $\frac{1}{20}$ sec. S after a value indicates surprise reaction.
'67' was the first, and '72' the last two-figure number for the first ten Ss. The order was reversed for the last thirteen Ss.
Reactions for first two-figure number and for '1' are excluded in compiling averages and ranges.

[1] The average variation in E's own reactions for auditory stimuli (see procedure for this experiment, Ch. II) was found to be less than 0·025, and was, therefore, regarded as negligible.

In order to arrive at the influence of surprise on the reactions the results will be considered in terms of the difference between the reaction for the first two-figure number and the highest of the reactions for other two-figure numbers, and the difference between the reaction for '1' and the highest of the reactions for other one-figure numbers.

In nineteen out of twenty-three Ss the first two-figure number caused surprise. In fifteen of these the reaction was increased by at least 0·4 sec. Of the remaining four cases, in BC and BL the reactions were increased by 0·3. In BC, however, the surprise reaction (reaction time for the number which caused surprise) was much longer than the average reaction. In DT the increase in the reaction was small, being only 0·1. In one case, IN, there was a decrease. But this S was very nervous throughout the experiment and her reactions were erratic and relatively high.[1]

In four Ss (BF, SR, FH and DL) the first two-figure number failed to arouse surprise. The reactions for that number show no marked increase over the others, except in the case of BF who reported 'fright'[2] for '72' and 'bothered' for '48'.

Compared with the first two-figure number, '1' caused surprise in a fewer number of Ss and to a lesser degree. It succeeded in causing surprise in ten out of twenty-three Ss. In two Ss (BF and DL) it succeeded in causing surprise when the first two-figure number failed to do so.

In five out of the ten Ss who experienced surprise the reaction was lengthened by 0·3 or more. In four others it was lengthened by at least 0·2 sec. Only in one S was the reaction for '1' considerably less than one other reaction and slightly less than another, but at least 0·3 longer than the rest. This was the same S, IN, whose reactions were observed to be erratic. Except in one S (JS) whose reaction was increased by 0·2, there was no marked increase in reactions when '1' failed to evoke surprise.

It seems, therefore, that both in the case of the first two-figure number and in the case of '1' reactions were markedly lengthened when the number caused surprise.

Can the increase in the reaction for the first two-figure number be attributed to some peculiar difficulty of response to that number?

[1] The reactions were 1·05, 1·1, 2·1, 1·45, 1·1, 1·8, 1·25, 1·8, 2·2, 1·3, 1·5 and 1·4.

[2] If 'fright' possesses an element of surprise, and it is believed it does (cf. Freud, *Beyond the Pleasure Principle*, p. 9), then the case of BF would be in conformity with other results.

The results show that this could not have been the case. The average reaction for '67' when it was presented first and caused surprise was 1·7, whereas its average reaction when it failed to cause surprise was only 0·95. Similarly for '72' the average reactions, when it caused surprise and failed to cause surprise, were 1·64 and 1·1 respectively.

Another possible objection may be raised against ascribing the lengthening of reactions to surprise. It may be argued that in view of the method of recording reactions adopted in this experiment there is a possibility that a non-conscious bias in E may have delayed E's own reaction in recording the response of S when a number with which E expected to cause surprise was presented. But in the results there are cases where the number which was intended to produce surprise failed to do so and the reactions in those cases show no considerable lengthening. This fact proves that the non-conscious bias mentioned above could not have affected the reactions, since a tendency of that type should manifest itself in all reactions as E had no means of knowing whether an S would be surprised or not by the number presented.

The extremely high correlation between the occurrence of surprise and a delay in reaction and the absence of any other explanation to account for the delay, point to the conclusion that the lengthening of the reaction-time was due to surprise.

The introspections of some Ss show that surprise affected both the thought processes and the motor reactions.

Eight Ss reported some difficulty in the process of addition (e.g. BL said, 'I had to stop for a moment before I was ready to add 3').

Thus it may be concluded that surprise tended to cause an arrest both of the mental activity involved in the task of addition and the physical activity involved in the motor response. It tended to induce a momentary immobility in the subject and hindered the operation of the impulse towards reaction in spite of the strong conative set which was established for the reaction.

The data derived from Exp. VII will be now considered.

Seven Ss gave introspections on twenty-six experiences of surprise in relation to which motor reactions were noted. Most of these occurred while the subject was sitting, walking, or standing; two of them occurred while he was driving a car and one when he was riding a bicycle, whereas in one case S was lying in bed at the time when she experienced surprise.

The reactions are given in the words of S in each case:

PF. (1) S was entering a room when he was surprised at the dresses of other people. 'Stopped breathing for a moment. Slight tendency to stop where I was. Probably slowed down my pace.'

(2) Sitting at a dinner table. Surprised at the unreasonableness of another. 'Relative immobility and speechlessness, a feeling of helplessness and a sinking feeling.'

(3) Entering a room, S was surprised at the sex appeal of a woman he had not met before. 'Catch in breath. Tendency to stop still.'

(4) Standing at a library counter. Surprise caused by the return of a library attendant empty-handed and saying that there was no copy of a book S had asked for. 'For a moment: I am helpless, don't know what to do.'

(5) The dropping off of a door of a motor van which passed S while he was driving a car. The experience was surprise mixed with fear. 'There was a momentary helplessness and feebleness (accompanied by muscular feebleness) followed by an immediate alertness and appropriate reaction.'

(6) Referring to the same incident, surprise mixed with curiosity at looking back and finding that the van had not stopped. 'Tendency to stop and see whether he (the driver of the van) does stop eventually.'

In three (1, 2 and 3) out of six cases, S had a tendency towards a cessation of the activity or movement in which he was engaged at the moment of surprise. In (4), where S was relatively passive, he reported 'helplessness' which is also indicative of the inhibitory effects of surprise. In (5) the same tendency displayed itself in 'helplessness' and 'feebleness', but the motor reactions at the moment of surprise seemed to be determined by the fear which came with surprise. In (6), where curiosity was inextricably mixed with surprise (and indeed appears to have preceded surprise as well), there was 'a tendency to stop and look'. In this case it is difficult to say whether this tendency belonged to surprise or to curiosity, or to both.

PP. (1) Pleasant surprise at the realization that a child of nine had corresponded with a firm of bookmakers. S was sitting listening to the child's talk semi-attentively. Following a 'sudden awareness', 'there was a physical stretching of the body, a chuckle'.

Here the surprise came with a strong feeling of pleasure and amusement. The expansive movements may be, therefore, attributed to the latter emotions.

DM. (1) Surprised to find a defective torch 'coming full on' when S pressed the switch, while sitting on a bed. 'I seemed to remain quite still....Then a kind of tension, probably an opening of the eyelids and mouth, and a general muscular tension.'

(2) At the sound of someone spitting in a library. S was sitting on a chair, tired and sleepy. There was a sudden awakening, with an experience which was more startle than surprise. 'A sudden involuntary kicking of the legs—eyes suddenly opened.'

(3) Heard a knock at the door while S was engaged in eating. 'Ceased eating—stayed still.'

(4) Continuation of (3). Opened the door and saw and recognized a lady friend. 'Stood still for a moment—almost automatically greeted her.'

(5) On being touched on the sleeve while walking and recognizing the person who had touched the sleeve. 'I turned quickly and then, after a moment, smiled and said "Hello".'

(6) Coming out of a theatre engaged in conversation, and walking straight on to the footpath of the main road. 'Found myself in the middle of the footpath—I looked around me—"in surprise".'

(7) At the peculiar spelling of a word, while S sat looking at a map. 'Motor reactions not marked....I merely paused for a moment.'

In four out of these seven experiences DM had a temporary pause or there was 'stillness' at the time of surprise. In one experience (2) there was a 'sudden involuntary kicking of the legs'. This experience was 'more startle than surprise', and the movements seem to be caused by startle or fear.

In (5) the 'Hello' follows a momentary pause. Here, however, there seem to be two surprises—first, at being touched on the sleeve and second, on recognizing the person who touched the sleeve. The first may have been startle. The reaction to it is cessation of walking in which S was engaged and a quick turning round. The surprise arising from recognition caused a momentary speechlessness before the habitual reaction of greeting took place.

In (6) the activity in which S was engaged at the moment of surprise viz. walking and conversation, does seem to be adversely affected by surprise.

KU. (1) While cycling at night in a narrow passage S saw a white object in front. 'Reflex tightening of the brake.'

In this case, an inhibitory tendency appears to have been extended, as it were, to the cycle which determined S's motion. The automatic

activity connected with situations of the type met with seems to have predominated or supervened.

MH. (1) Pulling at the handle of a door, which came off. 'My hand holding the door-knob remained stationary, my breathing ceased.'

(2) Suddenly remembering an appointment while lying in bed. 'My heart stopped beating for a second and then began to thump... at the moment of surprise there was general motor tension and stillness.'

(3) S sat testing a girl, when the latter suddenly had a 'jerking, grunting tic'. There was surprise mixed with fear. 'I too "jumped" and said "Oh" in the manner one does when receiving a sudden shock.'

Thus, in the first two experiences immobility is reported. The third experience caused a marked degree of fear. Hence the involuntary reactions connected with startle.

TR. (1) Sitting in a café S saw a person whom he thought he recognized. 'Tension,...an arrest of mental processes....Cessation of breathing with lungs in a distended position. The muscles of the limbs and trunk seemed to stiffen momentarily.'

In this S the inhibitory effect of surprise has affected even the mental processes and the involuntary activity of breathing.

SS. (1) In a library, walking, looking for a table to work at. Surprise caused by seeing a lady sitting at a table reserved for research students. 'I felt an inability to go on....It seemed as though I was stunned by the shock at first and I became rigid.'

(2) On being asked a question while sitting. 'My muscles were taut.'

(3) S was asked a question regarding a funeral while she was walking down the stairs. 'Felt taut and still. I stopped walking down the stairs and stood exactly where I was.'

(4) Surprised at a friend's coming into a room and going out without speaking a wood, while S was engaged in writing. 'Stillness.'

(5) Surprised, while writing a letter, at S's own style of writing. 'Tended to stop.'

(6) Standing and bidding good-night to a friend. Surprised at being called by her first name. 'I think I went rigid.'

(7) Surprised at finding herself speaking to a lady friend about S's private matters. S does not give motor reactions but says 'a desire to know my surprise by talking on'.

In three out of these seven experiences (1, 3 and 4) there is an actual cessation of the activity in which S was engaged at the moment of surprise. In (5) there is a tendency to such cessation. In (2) and (6) S reports 'rigidity' and 'tautness', while in (7) it is not clear how S reacted. Perhaps what she means by the phrase 'a desire to know my surprise by talking on' is that she felt additional impulsion necessary to continue talking as she wanted to stop and think over her experience of surprise. The degree of surprise was, in this case, very low so that it is possible that any tendency towards inhibition or otherwise may have escaped the notice of S.

These introspective data indicate an inhibitory tendency in surprise. Where the subject is actively engaged in some movement, such as walking, there is a tendency for that movement to cease under surprise. When the subject is more or less passive, the same inhibitory tendency manifests itself in experiences like a feeling of 'helplessness', 'muscular feebleness' or 'rigidity'. In some cases even 'speechlessness' and a momentary stoppage of the heart or a check in breathing is induced.

There is, however, some indication that when surprise comes mixed with another emotion or when it comes in connexion with a situation which arouses some strong habitual or impulsive reaction, the inhibitory tendency may be counteracted or superseded by the other tendency, habit or impulse aroused. In experiences in which surprise comes with fear, reflex or habitual reactions are particularly apt to predominate. In some cases where more than one tendency is present the resultant action may be of the nature of a compromise, e.g. when S slows down his pace under surprise.

General conclusion

The investigations discussed above show beyond question that surprise tends to arrest the motor activity in which the subject is engaged at the moment of surprise. Whether there is a strong and conscious conation, as under the conditions of the first three experiments, or whether the conation is at various degrees of strength and consciousness as in the experiences in Exp. VII, surprise tends to cause a check in the activities of the subject. There is also some indication that thought processes as well as involuntary activities involved in breathing and in the functioning of the heart may be checked under surprise.

CHAPTER IV

SURPRISE AND ATTENTION

A CLOSE connexion between surprise and attention has been observed by a number of psychologists.[1] The problem of this connexion was not one of those investigated in the present research. But some observations on it are suggested in view of the similarity of the inhibitory processes involved in both surprise and attention,[2] and in view of the fact that some of the introspective data, although meagre and often incidental so far as this problem is concerned, yet throw some light on it. There is some evidence, from the results of the experimental investigations, to show that the surprising stimulus becomes focal, however briefly—that it brings about what Ribot called 'a relative monoidism' in place of 'the normal condition of the plurality of the states of consciousness'.[3] The energy of the individual is withdrawn for the moment from the diverse channels in which it flowed to be directed towards the surprising object. There is a convergence of his mental processes in relation to that object.

In Exps. I, II and III it was seen that in spite of the strong conative set which was in operation, there was a temporary suspension of the motor activity at the moment of surprise. The mental processes of S appear to have been directed, momentarily at least, to the cognition and assimilation of the surprising event. The introspections of some Ss show that there was a momentary diversion of the mental processes into channels connected with the stimulus. For instance, in Exp. II ('Tapping and Light') the introspections of some Ss show that there was wonder or an attempt at explanation in relation to the surprising stimulus. E.g. GA 'wondered what the idea was'; WT 'realized it was part of the test'; BB 'thought something drastic had happened, something had gone wrong'; HB 'thought there was something wrong with the apparatus'; PR 'experienced a certain amount of wonder as to what was happening'; MR 'wanted to see what was happening'.

[1] See Part I.

[2] E.g. Ribot regarded the mechanism of attention as 'essentially motory' acting 'upon the muscles, and through the muscles, mainly under the form of inhibition' (*The Psychology of Attention*, p. 8). In case of spontaneous attention 'all motions are arrested' (*ibid.* p. 11). Pillsbury points out that attention has a tendency to 'inhibit movements in general' (*Attention*, pp. 21 sq.). Jones and Porteus refer to 'a muscular tension and rigidity' in attention (*The Matrix of the Mind*, p. 319).

[3] Ribot, Th., *The Psychology of Attention*, p. 10.

The arousal of curiosity and the attempts at assimilation are evidence that, momentarily at least, the surprising stimulus attracted and held the subject's attention even when he was engaged in an activity prompted by a strong conative set.

Similar evidence is obtained from Exp. V ('Expectation'). In this experiment S had just finished introspecting on another experiment (Exp. III, 'Verbal Addition'). His thought processes were centred more or less around what he had done. Of ten Ss, nine who experienced surprise continued looking steadily at E for some time when he snapped his fingers. Besides this their introspections, and in some cases the expression of puzzlement registered by their faces, indicate that the surprising stimulus became focal in their consciousness and demanded a convergence of their mental activities towards itself. The Ss reported wonder or curiosity and an attempt at interpretation or assimilation.

Exp. VII supplies some interesting material showing how the surprising stimulus influences the mental processes, including the emotional reactions. Some cases of particular interest are given below:

PF, when he was driving a car and he observed the back door of a van falling into the road, became alert in relation to this surprising event and his thought processes remained centred on it for some time afterwards.

PP, 'The fore period was of vague consciousness', but the surprising stimulus came with 'a feeling of full awareness'.

In RS, who was expecting his breakfast, the arrival of a letter caused surprise and occupied consciousness for the time being.

KU (1) while riding a cycle, was surprised by 'something white'. His subsequent reactions were connected with what surprised him.

(2) The vividness with which the surprising stimulus struck S is well described by him when he compares the bald head which surprised him, with 'a billiard ball'.

DM (1) was surprised when a torch, which he believed would not light, 'came full on'. The lighting of the torch led to 'a sudden, almost violent reawakening'.

(2) The mental contents before surprise were 'for all purposes nil'. S 'awoke with a start' because he thought he heard someone 'spit aloud' in a library, and the surprising stimulus was, he says, 'the only thing in my consciousness'.

(3) A knock at the door which surprised S put a stop to his autistic thinking and he 'wondered' regarding the knock.

(5) S was engaged in walking in a strange city, thinking of a number of things. There was a sudden stop to the processes going on in S when he was surprised to meet a person he knew and he turned towards her, thus bringing the surprising stimulus fully in the focus of his attention. The 'adventure emotion' which existed before was 'short-circuited' by 'the experience of surprise'.

MH 'was lying late abed, in perfect tranquillity' when she was surprised on 'realizing that an appointment had been overlooked'. The surprise caused her thought processes to centre around the fact that she had forgotten the appointment.

SS was working in her room when a friend came in, fetched something, and left without saying a word. This surprised S. Her thoughts became centred on that event for some time. Afterwards she 'went on writing but only after an effort', thus indicating that an effort was needed to drag her mind away from the surprising stimulus.

Other introspections also clearly indicate that the surprising stimulus demanded a convergence of S's attention towards itself.

The foregoing data afford some evidence, direct and indirect, that the surprising stimulus tends to become focal at the expense of the existing processes, whether cognitive, emotional or conative, which tend to be inhibited at least for the moment. Can it be then that the tendency of surprise to inhibit the motor activity in which the individual is engaged is only one aspect of the process of attention which is itself connected with surprise? Is surprise the affective aspect of the process in which an object is brought to full consciousness or awareness? If surprise is always associated with the 'irresistible act'[1] of involuntary attention, can we argue the converse and say that in all involuntary attention whatever there is an element of shock akin to surprise? If the process in which an object becomes conscious to the fullest degree is correlated with surprise, we might perhaps speculate that, in its genesis, all consciousness is connected with an affective experience similar to surprise in quality although at varying degrees of intensity. Spencer's theory of consciousness[2]—that consciousness is a shock—lends support to this speculation. Further substantiation for it can be based on the view that complete adaptation implies absence of consciousness, that consciousness

[1] Hamilton, Wm., *Lectures on Metaphysics and Logic*, vol. I, pp. 247 sq.
[2] Spencer, Herbert, *Principles of Psychology*, vol. I, pp. 147 sqq.

emerges in connexion with a state of lack of adaptation.[1] Since surprise is marked by a state of lack of adaptation, can it be that every state of lack of adaptation arouses a 'shock-full' consciousness? If 'without change consciousness is impossible',[2] if 'we are only conscious as we are conscious of change',[3] may it be that surprise, which is connected with marked changes, perhaps occurs, in varying intensities, in relation to all change, in relation to all consciousness, whatever? If this be the case, surprise may be the very first affective experience, occurring with the initial emergence of consciousness. The extremely early appearance of surprise in phylogeny as well as ontogeny[4] supplies an additional ground for the speculative assertion that an affective experience of the nature of surprise is connected with all consciousness and is clearly experienced as surprise in connexion with the high degrees of consciousness brought about in involuntary attention. It may be said, then, that it is the function of surprise to direct the attention, to effect an orientation of the organism towards the stimulus, indicating that further adjustment requires to be made, leaving the specific form of adjustment to other impulses according to the nature of the stimulus. An elementary form of interest is aroused which demands a 'directedness' of the organism towards the stimulus. It may be said that involuntary attention is the primary form of adjustment that must be made in relation to a stimulus before its specific meaning is cognized and that it is the function of surprise to bring about this initial stage in the relationship of the subject to the stimulus, in which the stimulus has merely an unspecified 'worthwhileness', and as such demands no more than an orientation of the subject towards itself.

[1] Cf., in this connexion, the principle of 'physiological invariability' held by Rignano (Rignano, Eugenio, *The Psychology of Reasoning*, trans. W. Holl, pp. 1 and 6, 1923, and *The Nature of Life*, trans. N. Mallinson, pp. 64 sq., 1930), and the 'complacency' theory of Raup, according to which an equilibrating tendency causes the activities of the organism to be focused on the restoration of a condition of equilibrium whenever lack of adjustment arises (Raup, R. B., *Complacency*, p. 3, 1925), this being true in the case of biological as well as mental maladjustments (*ibid.* pp. 88 sqq.). Freud says that perhaps the very first occurrence of consciousness was related to a state of lack of equilibrium, a state of tension, and that the process of the awakening of life itself was perhaps 'a prototype resembling that other one which later in a certain stratum of living matter gave rise to consciousness' (*Beyond the Pleasure Principle*, p. 47).

[2] Spencer, Herbert, *Principles of Psychology*, vol. II, p. 291.

[3] Ward, James, art. 'Psychology', *Encycl. Brit.* 11th ed.

[4] Seen in Part I.

CHAPTER V

SURPRISE AND THE PSYCHO-GALVANIC RESPONSE

In Exp. I ('Cards and Animals') the p.g.r. technique was employed in order to ascertain if that response is connected with surprise when that experience occurs under conditions in which the subject's mental state is predominantly cognitive. In some experiments conducted by different authors, it was found that startle, surprise, or sudden fear, caused by stimuli of the nature of sudden loud noises or sudden precipitation of the subject,[1] was particularly related to the p.g.r. The conditions of the experiments and the nature of the stimuli employed were, however, such that fear, sometimes of marked intensity, was bound to complicate the emotional state experienced. Sensory disturbances of a more or less violent nature were frequently present in the experiences aroused in those experiments. An attempt was made to avoid these complications by obtaining surprise under conditions in which the subject was engaged in a simple cognitive and motor activity and by stimuli which could not produce any appreciable sensory disturbances in the subject. The aim was to ascertain if what is termed 'cognitive surprise' by Shand and 'predominantly ideational' surprise by Patterson, is expressed through the p.g.r. It was not expected to avoid the arousal of other emotions altogether, but it was hoped that the most marked experience would be surprise and that in any case no violent sensory elements would accompany that experience.

For the purpose of convenience in presentation the results are given below in Table IV in terms of the heights of the curves measured in millimetres.[2]

Although twenty-four Ss had observed in the experiment, the results of only fourteen are available for examination, the others having been rendered useless due to frequent finger movements or owing to mechanical accidents.

All Ss reported surprise for the first animal and for no other.

Six out of the fourteen Ss (CA, BR, CL, DZ, HR and DA) reported only surprise, unmixed with any other emotion. In three, BR, DZ

[1] E.g. experiments of Landis, Blatz, Bayley and others (see Part I).

[2] The tachogram records can be seen in the writer's thesis at the University of London.

Table IV. *Heights of tachogram curves commencing within 5 sec. of the stimulus. Measured to the nearest ½ mm.*

	Stimuli				
Subjects	I	II	III	IV	V
CA	2	—	0·5	—	—
MC	—	—	—	—	—
BW	5	—	—	—	—
BR	2·5	0·5	0·5	1	—
CL	1·5	—	—	—	—
DZ	3·5 and 3	1	1	—	—
WT	4	0·5	—	0·5	—
LE	4	1	0·5	—	—
CV	2	—	0·5	—	—
AB	0·5 and 3	0·5	0·5	0·5	—
HR	3 and 5	8	1	1·5	0·5
BD	1·5 and 2	1	0·5	—	—
DB	3 and 14	1 and 3	2 and 1	1	1
DA	3	1	2	—	—

and DA, there were marked deflexions connected with the first stimulus which were higher than deflexions connected with other stimuli. In CA and CL the curves were of a lesser magnitude but were distinct. In HR there were a large number of deflexions. More than one marked deflexion followed the first stimulus while smaller ones occurred continuously.

Five Ss (MC, BW, LE, BD and DB) reported amusement for all stimuli in addition to surprise for the first. Of these the curves of BW and LE for the first stimulus were distinctly high and well marked. The deflexions related to other stimuli, where they occurred, were much smaller even though all stimuli caused amusement. BD had a small double curve, like that of DZ and unlike the well-rounded curves of other Ss. In the case of DB the tachogram was full of curves, which makes it impossible to say which curve was correlated with a particular experience. It is not unlikely that in the case of DB, as in that of HR, anxiety was present throughout and caused the constant fluctuations in resistance. E's observation of these Ss showed that they were markedly nervous and excited. The fact that these two Ss failed to follow the instructions regarding the reaction (they pressed the key before recognition), thus rendering their reactions erroneous, may further substantiate the inference as to the presence of anxiety. In both, however, the possibility is not excluded that one of the curves following the first stimulus was related to surprise.

MC gave no deflexion. The absence of deflexions may be due to S having a very high initial resistance. However, one has to bear in

mind the possibility that surprise in this instance may have failed to cause any fall in resistance.

The remaining three Ss (WT, CV and AB) reported surprise and amusement for the first stimulus and no emotion for any other stimulus. WT gave a marked deflexion for the first stimulus and very small ones for two other stimuli. In CV the first curve was a distinct one, the other being a very small curve for the third stimulus. AB gave multiple deflexions particularly for the first and third stimuli. It is not improbable that one of the curves following the first stimulus was related to surprise. Indeed, in the case of AB and in that of DZ the second curve may have been so related. The first curve in these cases commenced too soon after the stimulus to allow for the period of lag between the stimulus and the deflexion, if it was related to surprise.

The results show that in ten out of fourteen Ss surprise caused a deflexion. In three Ss who give multiple deflexions it is difficult to determine if surprise were responsible for any of them, but it may be observed that deflexions did occur when surprise was experienced. In one S there is no deflexion connected with surprise. But this S has given practically no deflexion and this lack of observable change in her resistance may be ascribed to a very high initial resistance. It might be, therefore, concluded that 'cognitive surprise' or 'predominantly ideational' surprise is connected with the p.g.r.

But, it may be asked, may it not be that the deflexions are due to amusement and not to surprise at all? The fact that six out of fourteen Ss have not reported amusement or any other emotion in connexion with surprise and further that in many instances where amusement was aroused no deflexion occurred, shows that amusement does not necessarily cause the p.g.r. The probability where surprise and amusement are simultaneously reported would be, therefore, that the p.g.r. is at least partially, if not preponderantly, due to surprise.

It is possible, however, that where amusement comes with surprise its strength may be enhanced by the latter emotion and the magnitude of the response may be considerably due to it.

The present study shows, therefore, that surprise, even when it is predominantly ideational, is connected with the p.g.r.[1]

[1] Darrow, C. ('Differences in the physiological reactions to sensory and ideational stimuli', *Psychol. Bull.* vol. XXVI, p. 197, 1929) concluded on the basis of works summarized by him that 'Momentary sensory stimuli are relatively more effective than ideas' in causing the

CHAPTER VI

THE INFLUENCE OF SURPRISE ON THE EMOTIONS ASSOCIATED WITH IT

A NUMBER of psychologists have observed, with varying degrees of clarity, that the intensity of emotions is increased when they are associated with surprise.[1] This tendency seems to have been implicitly assumed in the mode of stimulation in a considerable amount of experimental work on emotions, where the stimuli were given 'suddenly and without the knowledge of the subject'. The implicit assumption in these cases seems to be that the stimulus which is sudden and unexpected would produce more marked effects than one which is gradual and expected.

Shand regards surprise as 'a great heightener of the intensity of other emotions', and says that 'surprise tends to increase the intensity of the emotion with which it blends or by which it is rapidly followed'.[2]

In the absence of previous experimental investigations of the problem, a technique had to be devised to determine the influence of surprise on the intensity of other emotions associated with it. Exp. IV, in which six masks were employed as stimuli, was undertaken for this purpose.

Since the mask presented first was likely to arouse surprise, care had to be taken not to present in that position a mask which would normally evoke high degrees of emotion relatively to others. The

p.g.r. Patterson believes that her work confirms this conclusion in relation to surprise (*op. cit.* p. 105), and Ruckmick makes the generalization that 'emotions that involve a large ideational component, such as anxiety and dread, with obviously a smaller bodily disturbance, tend to be represented by deflexions of a smaller magnitude' (*Psychology of Feeling and Emotion*, p. 368). It seems that at least in the case of surprise, these statements are not justified. First, there is the objection that, in many of the experiments on the results of which these statements are based, the sensory elements and bodily disturbances aroused at the moment of surprise did not all belong to it but were caused, partially at least, by fear so that the magnitude of the deflexions could not be ascribed wholly to the sensory surprise. Secondly, the deflexions caused by the sensory and ideational types of surprise cannot be compared unless there is some criterion of measuring the intensities of the stimuli employed. No such criterion has been devised. This second objection would be valid in connexion with the studies of all emotions whatever. Since Ruckmick regards anxiety as one of those emotions which is represented by small p.g.r. deflexions, it may be pointed out that the work of Forbes (Thesis, University of London) has led him to a conclusion directly opposed to the view held by Ruckmick. The statements of Patterson and Ruckmick, therefore, appear to be, at the least, premature.

[1] See Part I.

[2] Shand, A. F., *The Foundations of Character*, p. 421.

TABLE V.

A value in italic indicates an I.E.
Values in bold face indicate simultaneous or mixed emotions.
An asterisk at the top indicates a surprise stimulus: at the bottom reaction to a surprise stimulus.

	ED	DA	VL	BB	ML	BH	RP	GD	RS	YB	PS	RB	KA	DD	SM	DB	SS	FR	HR	AR
	* *	* *	* * *	*	*	*	*	* * * * * *	*	*	* * *	*	* *	*	*	* *	*	*	* * *	* * * * *	* * * * * *
	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI	I II III IV V VI
1 Surprise	7 4 0 0 0 0	3 0 **4** 0 0 0	**2** 0 – 0 0 0	0 0 0 0 0 2	0 0 0 0 0 0	6 0 0 0 0 0	0 0 0 0 0 2	0 3 6 6 0 6	0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 **5** 0 0	3 0 0 0 0 0	6 0 1 0 0 0	6 0 0 0 2 0	0 0 0 4 0 0	8 6 **7** 5 2 2·5	0 6 0 0 0 0	1 0 0 1 1 0	9·8 9·8 2 **9·5** 0 0	9 0 0 4 1 4·
2 Pleasant Surprise															6					
3 Startle		**4**	**4** 7 4					7	8		7 **5**								8	
4 Shock								2												
5 Amazement										8										
6 Repugnance		2	6		9		2 4	7 5			7 6			4 5 4			8 6		7·5 10	8
7 Aversion	6 7							3 5									9		**9·5**	
8 Horror								7 5 5								7				
9 Disgust								6 6												
10 Distaste		1 1	3	3					2 3 5 2	8 1				2		8 8 4 3·5				
11 Dislike	6 5 8 3 2		4						2 1·5								7 4 6 9	6 8 **3** 2		5·5 5·5 3·5
12 Displeasure								4 4 4·5 5 5												
13 Antipathy																				6
14 Apprehension									8 1·5					3						
15 Alarm														3						
16 Fear	2							5 7			7					4	3			
17 Fright			4																	
18 Fascination																8 6 1 8				
19 Awe											2									
20 Anxiety																				
21 Anxiety mixed with Curiosity													1·5				3			
22 Curiosity							4			4 1	6	5	8·5 8·5 2·5 8·5 4·5 7·5	4 4			6 7			
23 Wonder				2 4					2		5 5		4		3				6·5	
24 Puzzlement														2		8 9 2 2 1				
25 Amusement	4 1·5	7 2 4	5 2	5	4 1	6	1 1 2			6 3 4 5	2 3	7	4·5 3 2	1·5 4		8		1 6	3 2·5	10 9 9 4·5 4·5
26 Indifference																		3 5		
27 Disappointment		5			5 7 7					4 1 8 4				1·5 2		9 4 6	5 8 4 7		5	
28 Boredom											3 1 9		6·5 6·5							
29 Discontent					10 10							1								
30 Irritation		5			10 10							5					4·5 5	3		
31 Annoyance		4			10 10												7	3		
32 Despondency																	4			
33 Contempt																5				
34 Liking				4								4			10 9·5 5·5 8 7 5	6 2	6			
35 Pleasure																	4 6 8			
TOTAL EMOTIONAL UPSET	25 11 5 8 3 3·5	10 2 14 0 3 4	15 5 13 13 4	2 5 3 4 0 6	9 1 7 7 30 30	15 6 0 0 0 0	1 3 4 0 0 8	12 17 17 21·5 22 24	18 3·5 1·5 3 5 4	22 4 16 8 5	21 2 7 27 7 9	8 0 1 7 9 0	23 3·5 3·5 11·5 13 14	9 1·5 9 9 12 9	16 12·5 5·5 12 7 5	21 22 38 20 22 27	15 32 24 34·5 18 19	10 8 4 9 7 5	12·8 12·2 2 24 0 6·5	26·5 24 14·5 18·5 9 17·
	* *	* *	* *	*	*	*	*	* * * * * *	*	*	*	*	* *	*	*	* * * * * *	*	* * *	* * * *	* * * * * *

masks were therefore shown to four subjects (none of whom was employed in the experiment proper) and a mask which seemed to be one of the least repulsive to them was chosen to be shown first. To guard against this judgement being erroneous the chosen mask was presented first to one group of ten subjects and last to another group. The mask presented last to the first group was presented first to the second group, the order of the others remaining unchanged.

Results and their treatment

The results are given in Table V.

The belief that the stimuli were capable of arousing similar emotional reactions was confirmed by the fact that no fewer than sixteen Ss reported emotions of the nature of aversion or dislike. These were reported in relation to fifty-eight out of 119 stimuli. That each mask was capable of evoking such emotions was shown by the fact that the frequency of report is fairly evenly shared by all the masks, being 9, 10, 13, 10, 8 and 8 respectively for masks 1–6. This distribution further indicates that the judgement regarding the moderate efficacy of masks 1 and 6 was not erroneous, the masks which aroused aversion-like emotions most frequently being the second, third and fourth.

The data will be treated from the following points of view:

(A) *From the point of view of the emotion immediately aroused by the stimulus*

Under this heading will be compared, for each S, emotions which occur simultaneously with, or immediately following, surprise, on the presentation of stimuli, with emotions which occur immediately on the presentation of stimuli but without any accompanying or preceding element of surprise.[1]

Since an exact determination of the connotation of the term 'immediate' or 'rapid succession' would not be possible when dealing with mental states and processes, the definition of the term must be necessarily rather arbitrary. Only the first emotional reaction has been, therefore, chosen as 'immediate' in order to avoid the complications that may be introduced by detailed cognitions of the stimulus.

[1] The emotions which occur either immediately on the presentation of a stimulus or, where an element of surprise is first evoked, immediately after such surprise, will be designated as IEs for the sake of brevity, other emotions being called LEs (later emotions). Values for the intensities of the emotions will be indicated in brackets and the stimuli will be referred to as I, II, etc., representing the order of their presentation.

Since comparisons between emotions are to be instituted, it is necessary to determine first what emotions may be compared. In spite of the apparent similarity of the stimuli, the reactions of the Ss to all of them are not likely to be identical or in some cases even similar, owing to individual differences, particularly in experience, interests and attitudes, and the effect these are likely to exercise on the reactions of Ss to a series of stimuli. But if the emotional reactions are very different, it would not be a justifiable procedure to compare their intensities. It would be erroneous to compare the intensities of emotions which are as markedly different from each other as, for example, repulsion from amusement or liking or curiosity, since in such cases the similarity of stimuli, on the assumption of which the comparison proceeds, does not exist at all, the stimuli possessing entirely different meanings. But it seems permissible to compare emotions when they are similar, e.g. repulsion with dislike or even fear, when allowance has been made for the different strengths of these emotions. This view is based on the assumption that certain elements are common to, or similar in, a number of emotions.[1] The assumption was substantiated by introspective reports of some Ss (e.g. ED said, regarding aversion and dislike which she reported for most of the stimuli, that there was 'more or less the same sort of emotion for all of them'). Thus repugnance, aversion, horror, disgust, distaste, dislike, displeasure and antipathy have been considered as falling under one group within which emotions will be regarded as comparable with each other. For the purposes of convenience, the emotions of this group have been termed '*Aversion-like*' emotions, basing the selection of the term on the more or less common conative element of these emotions, viz. to 'turn away' from the object that arouses them.

(B) *From the point of view of the total emotional upset in each S*

In view of the short period of time during which each mask was exposed to S it might be considered as not unreasonable to regard all the emotional reactions which occurred as 'immediate' or 'rapidly following' reactions. The data will, therefore, be dealt with from the point of view of the total emotional disturbance within the period of

[1] Cf., for instance, the view of Hiram Stanley that fright, alarm, terror, dread and horror are the primary differentiations of fear (Stanley, Hiram, *Evolutionary Psychology of Feeling*, p. 120).

stimulation, and the total emotional upset caused in each S by stimuli which evoked surprise will be compared with the total emotional upset caused in the same S by stimuli which failed to evoke surprise.

(C) *From the point of view of the relative values of mask no.* 1 *and mask no.* 6

Since mask no. 1 was used as the first stimulus and mask no. 6 as the sixth stimulus for a group of ten subjects and this order was reversed for another group of ten subjects, a comparison of the emotion values of these masks when they were used as I and evoked surprise with their values when they were used as VI and failed to evoke surprise, should give some indication as to the effect of surprise on their efficacy to evoke emotion.

It is assumed that when the emotive values of the masks are taken for two groups as wholes, individual differences in types and intensities of reactions and also the differences in the standards of evaluation would tend to be minimized, thus affording some measure of the influence of surprise on the emotional value of the masks.

(D) *From the point of view of the total emotional upset*

Under this heading will be compared the total amount of emotional upset caused by stimuli which evoked surprise with the total emotional upset caused by stimuli which did not arouse surprise. This procedure is open to the criticism that the values of intensities provided by the different Ss, although they might be regarded as comparable for the same S, cannot be considered as such when different Ss are concerned, since it would be erroneous to treat the standards of measure of different Ss as identical and on that basis to pool the different values given in total products. However, this procedure will be adopted in the hope that, since a group of twenty Ss is taken as a whole, there is a possibility that the differences in the standards of evaluation would tend to be neutralized.

After treating the data from the foregoing points of view, the p.g.r. records will be examined, and after that results obtained from Exp. VII will be considered.

A

Six Ss—DA, VL, PS, SM, DB and HR—reported emotions which were simultaneous with or blended with surprise. In the first three of these the simultaneous emotion was startle.

In DB horror was mixed with surprise, but as all other stimuli had evoked surprise as well, there was no value with which the value of horror could be compared for ascertaining the influence of surprise.

In SM the first emotion was a pleasant surprise. In HR a very high degree of aversion was mixed with surprise. Here again comparison is not possible since no aversion-like emotion was reported for any stimulus which failed to cause surprise.

In seven Ss (VL,[1] BB, RP, RS, YB, SM and SS) the emotions which came with, or immediately followed, surprise had higher values than others. The emotions which had their strength thus increased by surprise were, in three Ss, aversion-like, while in others they were wonder, curiosity, amusement and liking.

In DA the value of amusement was enhanced by surprise, but there was no comparable emotion for disappointment which was IE for III which also evoked surprise.

In ED surprise was aroused by I (7) and II (4). Aversion was reported for both, the values being (6) and (7) respectively. Dislike was reported as IE for III (5), V (3), VI (2) and IV (8). The values of the first three are thus lower than those of aversion for I and II, but IV aroused dislike of a slightly higher value. Apart from the milder nature of the emotion as compared with aversion, S's introspection offers an explanation for the high value of dislike for IV. S said: 'A little bit of fear before I saw it—apprehension at the thought of something frightful coming. I think that made me dislike it more.'

Although, in this S, surprise was more marked for I than for II, the aversion value of I was slightly less than that for II. There were, however, LEs of dislike (6) and fear (2) for I and no similar LEs for II.

In KA the intensity of amusement was enhanced when it came with surprise. But KA also experienced surprise (1) for III with curiosity (2·5) as IE, which was much lower in value than curiosity (8·5) for II. It must be borne in mind, however, that the degree of surprise for III was very low and also that the surprise was experienced, not at the picture itself but, as S says, at the fact that 'the same type of picture was shown again'. Thus, recognition and classification of the stimulus had already taken place before either the surprise or the curiosity was aroused.

[1] In this S, III was rendered invalid owing to an accident; hence it is not taken into account. Since other reactions are valid, there seems to be no objection to the inclusion of the results in the data.

In the ten Ss mentioned above surprise had, thus, an intensifying effect on the emotions associated with it.

In eight Ss the effect of surprise on associated emotions could not be measured owing to the absence of comparable data. One S (ML) experienced no surprise at all. Two (GD and DB) reported surprise for all stimuli, while in five Ss (BH, PS, RB, DD and HR) the IEs for stimuli which caused surprise could not be compared with IEs for other stimuli owing to the disparate nature of the emotions involved. It might be noted that in four out of these eight Ss aversion-like emotions of high intensities were reported.

Two cases (FR and AR) remain to be examined. FR reported a very low degree of surprise (1) for I, IV and V. The IEs were dislike (6) for I, annoyance (3) for IV and amusement (6) for V. II and VI had dislike as IE with the values of (8) and (2) respectively. Thus, although dislike for I is stronger than dislike for VI, it is weaker than that for II. It must be observed, however, that the intensity of the surprise experienced was extremely low.

AR reported surprise for I (9), IV (4), V (1) and VI (4·5) and startle (8) for II. The IEs were repugnance (7·5), (10) and (8) respectively for I, II and VI, and dislike (5·5) and (3·5) respectively for IV and V. III, for which no surprise was reported, had for its IE dislike (5·5). This is lower than the stronger emotion of repugnance in I, II and VI, the same as IE for IV and higher than IE for V. In this case, therefore, it appears that although high degrees of surprise have markedly affected the intensity of the immediately following emotions, surprise of lower degrees seems to have failed to do so.

The foregoing data indicate that emotions which are associated with surprise, or with an experience involving an element of surprise, tend to possess higher intensities compared with those emotions which are not associated with surprise.

Among the emotions which were heightened in their intensity by virtue of their association with surprise are four cases of aversion-like emotions, three cases of amusement, one of wonder, one of curiosity and one of liking. In four cases in which emotions, occurring in association with surprise, could not be compared, the emotions, whose intensities were very high, are aversion-like.

B

Considering the data now from the point of view of the total emotional upset in relation to each stimulus, it is seen that of the

twenty Ss, three (ML, GD and DB) cannot be considered since the first reported no surprise while the last two reported surprise, or an emotion containing an element of surprise, in relation to all stimuli.

Out of the remaining seventeen Ss in nine (ED, DA, VL, BB, BH, RP, RS, YB and PS) the values of the total emotional upset are higher for stimuli which evoked surprise (or an element of it)[1] than for those which did not. It might be noted that, in four out of these, there were more than one surprise stimulus, each one of which caused greater emotional upset than non-surprise stimuli.

In one S (DD), who reported surprise in relation to two stimuli, the emotional value of one surprise stimulus is higher than all other values, while that of the other stimulus is higher than one value but equal to the rest.

In five Ss (KA, SM, FR, HR and AR) there were more than one surprise stimulus. In each S, however, only one surprise stimulus was lower in its emotive value than one or more of the non-surprise stimuli.

KA had two surprise stimuli of which one had a much higher emotional value than the rest. The other surprise stimulus, which produced less emotional disturbance than the rest, had an extremely low surprise value.

SM had two surprise stimuli of which one had a definitely higher value than the rest, whereas the other had a value higher than those of all stimuli but one which exceeded its value by only (0·5).

FR had three surprise stimuli, I, IV and V, of which I and IV were higher in their value than others, while V was slightly lower than II.

HR had four surprise stimuli of which three had higher values than the two non-surprise stimuli, but III had a value lower than one and higher than another.

AR had five surprise stimuli. Four of these had a higher value, and only one a lower value, than the non-surprise stimulus.

The remaining two Ss had one surprise stimulus each. In RB the surprise stimulus had a definitely higher value than three of the non-surprise stimuli, slightly higher than one more, and slightly lower value than another, the difference being of (1) only.

In SS the surprise stimulus had a value which was much higher than all other values except one. Stimulus IV, however, had the

[1] In DA, VL, PS and HR, each of whom reported two simultaneous or mixed emotions, the values for both emotions are counted in. But even if only one is included the totals compare favourably with others.

slightly higher value of (34·5) as compared with (32), the value for the surprise stimulus. It might be noted that disappointment contributed substantially to the values of the last four stimuli and particularly to that of IV, indicating that the efficacy of these stimuli was likely to have been enhanced owing to the frustration of a strong expectant desire for a change in the type of stimuli presented.

There were thus twenty-six cases of surprise stimuli each one of which evoked greater total emotional reactions than non-surprise stimuli; there were six cases in which the surprise stimulus had a value lower than only one non-surprise stimulus and higher than the rest; there was one case in which the surprise stimulus had a value higher than one non-surprise stimulus and equal to the others, while in only one case did the surprise stimulus (which had a surprise value of (1)) have a value lower than the rest.

Thus, on the whole, surprise stimuli possessed higher emotive values than non-surprise stimuli.

It seems, therefore, that emotional disturbances which contained an element of surprise tended to be more intense than those which lacked such an element.

Bearing in mind the shortness of the period for which the stimuli were presented, it does not seem erroneous to say with regard to emotional upsets of short duration, that, so far as the present evidence goes, a surprising stimulus tends to increase, not merely the intensity of the emotion which comes with or immediately follows surprise, but also the total amount of emotional upset caused by the stimulus.

C

The emotive value of the first and sixth masks, when each was presented as first stimulus to one group of ten Ss and last to the other group of ten Ss, will be now examined.

Mask no. 1, when presented as the first stimulus, evoked surprise in seven out of ten Ss with an average value of 11·5 per S when surprise values are not taken into account, and 16·7 when they are. As against these averages, there is the average value of 8·4 for the same mask when it was presented last and failed to evoke surprise in eight out of ten Ss. Clearly, therefore, the average values of mask no. 1, when it was presented first and evoked surprise, are much higher than the average values of the same mask when it was presented last and failed to evoke surprise.

Mask no. 6, when it was presented first, evoked surprise in nine out

of ten Ss, with an average value of 10·2 (surprise values excluded) and 16·4 (surprise values included). Compared with these, its average value when it was presented last and failed to evoke surprise, in seven out of ten Ss, was 6·8, which shows that its emotive value was definitely enhanced when it caused surprise.

Comparing the average emotive values of mask no. 1 when it was presented last and yet evoked surprise in two out of ten Ss with its average value when it was presented first and failed to evoke surprise in three out of ten Ss, the same conclusion is borne out. In the former case the average is 18·5 when surprise values are omitted and 22·0 when they are counted in. In the latter case the average value is 4·0. This very low value must be attributed, in part at least, to the low values in general with which two of the three Ss responded.

The average value of mask no. 6, when it was presented last and yet evoked surprise in three Ss, was 9·3 (without surprise values) and 12·6 (with surprise values), whereas in the one case in which it failed to evoke surprise when presented first, its emotive value is fifteen which is higher than the first two averages. But it should be noted that the Ss who returned very low values in the previous comparison again figure here, while on the other hand, the S (SS) who was not surprised by mask no. 6 returned very high values for all the stimuli. It can be observed, however, that the score for mask no. 6 is the lowest as compared with the scores for other masks.

The emotive value of the stimuli was therefore enhanced when they evoked surprise.

D

If the total value of the emotional reactions aroused in all Ss by stimuli which evoked surprise is compared with the total value of emotional reactions aroused by stimuli which did not evoke surprise, it is found that the average value for forty-six stimuli of the former type is 11·9 (surprise values excluded) and 16·7 (surprise values included) as compared with the average value of 7·2 for seventy-three stimuli of the latter type.

From the point of view of the total reactions as well, it seems, therefore, that the occurrence of surprise tends to increase the intensity of accompanying or succeeding reactions. In view, however, of the sources of error involved in a comparison of this nature these results can be used only to substantiate the conclusion already arrived at on the basis of a more reliable treatment of the data.

Treatment of the data from the foregoing points of view all yielded the same conclusion. Taking into account the difficulty of making fine distinctions in the temporal succession of the emotions which come with surprise, the conclusion can be drawn that surprise tended to increase the intensity of the emotions which were associated with it.

P.G.R. RECORDS

Before proceeding to examine the results, it may be noted that in some previous investigations with the p.g.r. technique observations bearing on the present problem are to be found although these investigations did not specifically deal with the problem.[1]

These investigations are indicative of the enhancive influence of surprise or startle on the size of the deflexions.

The p.g.r. records obtained in the present investigation are given in Table VI. For the purpose of convenience in presentation the heights of the curves were measured off in terms of millimetres.[2]

Table VI. *Deflexions commencing within* 10 *sec. of the beginning of stimulation, total period of stimulation and allowance for lag being* 5 *sec. each*

Stimulus ...	I	II	III	IV	V	VI
Subjects						
BH	7 and 3	—	—	—	1	—
RS	4	1	1	1	1	—
YB	3·5	1	0·5	0·5	0·5	1
PS	7 and 8	3 and 2	2	1	1	0·5
RB	4·5	1·5	2	1	2 and 0·5	1·5
KA	3	1·5	1·5	1	—	—
DD	8	2	4	3·5	3	2
DB	1·5 and 1	0·5 and 2·5	0·5	3 and 5	0·5	—
SS	1·5	3·5	1	1	1	1
FR	5 and 2	1·5 and 0·5	3	3	4 and 1	0·5
AR	1	0·5 and 0·5	0·5	0·5	6	—

Eleven out of twenty records are available for examination, the remainder having been rendered useless owing to frequent finger movements on the part of S or owing to mechanical defect.

Out of these eleven, in five records, viz. those of BH, RS, YB, RB and SS the surprise reactions are clearly larger than others. It might be noted that RB and SS, whose introspective reports gave higher total values for V and IV respectively as compared with the surprise stimuli, have reacted with clearly larger deflexions to the surprise stimuli.

[1] See Part I.

[2] The curves as they occurred can be seen in the present writer's thesis at the University of London.

The case of SS is particularly important since in it the surprise reaction occurs in relation to II, thus indicating that the greater magnitude of surprise reactions in the other four subjects was not due to the initial position of the surprise stimulus.

PS gives two large deflexions for I, very much higher than those for others. But IV, which is also a surprise reaction, has a deflexion larger than that for VI, equal to the one for V, and smaller than the rest.

In KA the deflexion for I is definitely higher than all others, but the deflexion for III is equal to that for II although higher than others.

In DD I has a definitely larger deflexion than others, but V—also a surprise stimulus—has a deflexion lesser than those for III and IV and greater than the rest.

FR had three surprise reactions—to I, IV and V. Of these I and V have deflexions which are larger than others, but the deflexion to IV is equal to that for III though larger than others.

DB's deflexions are not comparable for the present purpose since surprise was involved in all the responses.

In AR there was no deflexion for III which is the only stimulus which failed to evoke surprise. I, II, IV and VI occurred during slight deflexions and had either no deflexions, or only negligible ones, of their own. Only V gave two large deflexions although rather belated. In view of the duration of the stimulus which was 5 sec. and the normal period of lag between the stimulus and the commencement of the deflexion which may range from 1 to 5 sec., the deflexions in this may be due to the emotions evoked by the stimulus.

There were, therefore, five Ss who had definitely higher deflexions for surprise stimuli than for others. In three Ss the stimuli for which marked surprise or startle was reported gave larger deflexions than all other stimuli, although other stimuli for which much lower degrees of surprise were reported yielded deflexions which were greater than some of the deflexions for some non-surprise stimuli equal to some others and smaller than a few. In one S two surprise stimuli caused larger deflexions than others while one failed to do so. In two Ss the deflexions were not comparable.

It seems therefore that on the whole deflexions which are related to surprise or startle tend to be larger than those which occur in relation to stimuli which fail to evoke surprise.

But any conclusion based on p.g.r. data must necessarily be extremely tentative in view of the highly controversial nature of the

question of interpretation of the response. Even assuming that the deflexions are correlated with emotional reactions, the difficulty of interpretation is in the present case further aggravated by the fact that some psychologists consider the response to be specially related to surprise, shock or startle.[1] An acceptance of this view would indicate merely the degrees of surprise or startle rather than those of other emotions which surprise is supposed to have influenced. This objection, however, is not in agreement with the results which indicate that the response does seem to be connected with other states than surprise or startle. The occurrence of two or more deflexions in relation to the same stimulus, as also the occurrence of the response in cases where surprise was not reported and its virtual absence in a few cases where it was, further show that the response is not specific to surprise or startle.

But, however reassured one may feel as to the possibility that the response does not merely indicate degrees of surprise and that it may indicate the strength of other emotions, yet the rather erratic nature of the response and the controversial character of the question of interpretation should lead one to be cautious in ascribing any considerable importance to the results based on p.g.r. data. At best, therefore, they may serve as supplementary evidence for the conclusion that surprise tends to increase the intensity of the emotion which is associated with it.

Further data in connexion with the problem were supplied by Exp. VII. It might be remembered that in that experiment Ss were asked to judge in what way, if any, surprise tended to affect the intensity of the emotion or emotions which came with it or immediately followed it.

Seven Ss, who were trained introspectors, expressed judgements in relation to twenty-two experiences which involved surprise.

In fifteen cases it was affirmed, sometimes with emphasis, that surprise increased the intensity of the emotions which came with it or immediately followed it. The emotions heightened by surprise are given below:

PF. (1) *Disappointment* accompanying and succeeding surprise, followed by *annoyance*, and (2) *annoyance* with surprise—later swamped by *anger* and *depression*.

RS. (3) *Annoyance* following surprise was 'increased by surprise if not wholly due to it'.

[1] See Part I.

DM. (4) *Wonder* accompanying and following surprise, (5) *alertness* and *wonder* following surprise, (6) and (7), *wonder* following surprise, and (8) *recognition* (feeling of) coming with surprise.

MH. (9) *Annoyance* following surprise.

SS. (10) *Envy* and *regret*, and (11) satisfaction, following surprise. (12) Sorrow, (13) displeasure and (14) irritation coming with surprise. With regard to the last, S says, 'I should not have been so irritated, in fact not at all, had I expected it.' (15) Horror and pity accompanying and following surprise. S says 'The horror seems to have been due to the unexpectedness.'

For the remaining seven experiences, the judgements expressed were as follows:

PF, in relation to an experience of *surprise, fear* and *alertness*, says that it was difficult to distinguish between these emotions. The last of these, viz. alertness, was 'suddenly increased' in response to a situation demanding immediate readjustment.

PF, in relation to an experience of *surprise* and *disappointment* and DM in relation to an experience of *pleasant surprise* cannot say whether the intensities of the emotions were increased by the surprise or not.

SS thought that *pleasure following surprise*, in one experience, 'did not seem to be increased'. In this case S had confided in a person in whom she did not think she would confide. This fact appears to have counteracted her pleasure which was connected with a feeling of relief that she had 'told' someone.

In KU *anxiety* and in MH *fear*, both of which came with surprise, were wholly due to the latter emotion.

PP, with reference to an experience of *surprise* followed by *wonder*, *amusement* and *tender emotion*, opines that he cannot envisage the emotions without the surprise.

Among the emotions which were intensified there were four cases of annoyance, one of irritation and one of displeasure, and four cases of wonder. Besides these, disappointment, depression, alertness, envy, regret, horror, pity and sorrow, and the feelings of recognition and satisfaction were intensified by surprise.

In all there were fifteen experiences in which surprise had an intensifying effect on emotions which came with it or immediately after it, two experiences in which surprise was deemed to be the cause of the emotions which followed, three more in which its effect could not be determined, while there is not a single experience in which it had an adverse effect on the intensity of other emotions. These data

supply good corroborative evidence in support of the conclusion that surprise tends to increase the intensity of the emotions associated with it. There is also some indication, as seen from the cases where the emotions aroused were wholly ascribed to surprise, that an object or situation which normally possesses no marked emotional significance may acquire an emotional meaning if it is associated with surprise.

Conclusion

The foregoing investigations have, on the whole, substantiated the view that surprise tends to enhance the intensity of the emotions associated with it. Since, however, in the present investigations, the emotions enhanced in their intensities were mainly of the type of aversion, wonder or curiosity, or amusement, with a few cases of annoyance, depression and others, no sweeping conclusion can be drawn as to the influence of surprise on the intensities of emotions in general. But, in view of the variety of emotions which had their intensities increased owing to their association with surprise, it does not seem improbable that further investigations may yield similar conclusions regarding other emotions as well.

CHAPTER VII

SURPRISE AND EXPECTATION

A NUMBER of psychologists refer to expectation in connexion with surprise,[1] but the relationship between the two has not been adequately clarified. So far as the present writer is aware no experimental work has been done to determine the nature of the relationship. It was thought that an experimental investigation of the problem might throw some light on this relationship and might also yield knowledge regarding the wider question of the stimulus of surprise.

Practically the whole range of the present experimental investigations supplied some data for the study of the problem, although all experiments were not devised to investigate this specific problem and are therefore not equally important in this connexion. In Exp. V the relationship between expectation and surprise was the problem specifically investigated. In Exp. VII it was one of the principal points on which attention was focused. In Exp. VI, although a study of surprise in relation to laughter was the main concern, introspections on expectation were also obtained. These have given some valuable data. In the first four experiments attention was not directed to the problem of expectation even as a secondary aim. Yet, the introspections of the subject and the knowledge of the situation and of the activity in which the subject was engaged at the time of the stimulus have been helpful in furnishing further data for consideration.

Before proceeding to deal with the available material it is essential to be clear regarding the meaning of the term *expectation*.

In her monograph on the subject, Hitchcock defines expectation as 'the reference of present ideas or images to future presentations within one's individual experience'.[2] Expectation is a 'decidedly active state'[3] which is dependent on past experience.[4]

From Hitchcock's discussion of the subject it seems that the following are the essential elements in expectation:

(1) An active state of consciousness.

(2) A present image or idea.

[1] See Part I.

[2] Hitchcock, Clara M., 'The psychology of expectation', *Psychol. Rev. Monogr.* vol. v, p. 9, 1903.

[3] *Ibid.* p. 10. Felix Arnold thinks that there is 'a strong conative attitude' in expectation ('The psychology of interest', *Psychol. Rev.* vol. XIII, p. 302, 1906). A similar view is held by James Ward in his article on 'Psychology' in the *Encycl. Brit.* (11th ed.) and in his *Psychological Principles* (p. 210).

[4] Hitchcock, *op. cit.* pp. 10 sq.

(3) A belief[1] that what is represented by that image or idea will itself become a presentation.

(4) Future time reference.

While these elements are indispensable for every expectation at its inception, it should be remembered that, during the normal functioning of the mind, at any given moment there might be expectations with one or more of these elements at various degrees of strength or specificity.

An expectation might be at different degrees of consciousness. It might be within the focus of attention or on the fringe of consciousness. It might be even totally non-conscious. Hitchcock says that expectations may become 'fairly automatic and serve as aids to thought and volition without demanding attention for themselves'.[2] Many of our expectations become habitual and 'appear and fulfil their function without...attracting attention'.[3]

Further, what is expected might be at different degrees of specificity. 'The definiteness of the expectation would be lost and the idea in its forward reference would become generic.'[4]

It is probable that the belief element, too, might have various degrees of strength, and the temporal element might be at different degrees of specificity, e.g. one may expect a letter with varying degrees of certainty and precisely at 6 p.m. or sometime in the evening.

Bearing this analysis of expectation in mind, the data are dealt with in the light of the following questions:

(1) Was an expectation present immediately before the experience?

If there was an expectation,

(2) Was it fulfilled?

or (3) Frustrated?

[1] The '*belief*' element in expectation is well emphasized in the definition of expectation given by J. M. Baldwin and G. F. Stout. Expectation is defined by them as 'a belief that future experience will be of a definite sort, based upon past experience' (*The Dictionary of Philosophy and Psychology*, vol. I, p. 176, 1901). Betrand Russell regards expectation as a kind of belief (*The Analysis of Mind*, pp. 176 and 250).

[2] Hitchcock, *op. cit.* p. 41.

[3] *Ibid.* p. 54.

[4] *Ibid.* p. 50. Koffka believes that expectation may consist of merely 'a consciousness that something is missing' (Koffka, K., *The Growth of the Mind*, p. 243). Although such a use of the term expectation is erroneous since the element of belief with reference to the future experience of that 'something' is lacking, yet it is possible to expect 'something' to happen, in which case the object of expectation will be very vague indeed. It is doubtful, however, if that vague 'something' can be totally unrepresented in terms of image or idea.

Further,

(4) Was the stimulus *contrary to expectation*? i.e. did it possess characteristics of a nature contrary to those of the object or event expected? (E.g. when a tall man is expected to enter a room a midget enters.)

(4) will be a limiting case of (3).

Or (5) Was the stimulus merely *non-expected*? i.e. one in relation to which no conscious expectation existed at the moment of its occurrence.[1]

It may be observed that questions (1) and (5) are not the same question in different forms. Although in every case where no expectation exists the stimulus will be non-expected, yet the converse may not be true since the subject can expect something unrelated to the stimulus.

It was thought that if the data are analysed in the light of these questions it would be possible to arrive at some conclusions regarding the relationship of expectation to surprise. Further, it was hoped that the analysis might yield some knowledge with reference to the problem as to whether in surprise the emphasis falls on the way the surprising stimulus affects the expectation of the subject or on the nature of the experience.

Since introspective reports had to be relied on for the purposes of analysis, the answer to the first question, as to whether an expectation was present or not, was not easy to find in every case. Since expectations may be at various degrees of consciousness and may be even completely non-conscious, it would be extremely difficult to ascertain if a non-conscious or habitual expectation existed or not. The not unfounded claim on the part of some psychologists that expectation is implied in all knowledge[2] and meaning,[3] further complicates the issue.

Moreover, it seems that at any moment the activity of an individual is conditioned by a multiplicity of expectations, explicit or implicit, at varying degrees of consciousness, from the fully focal to the entirely non-conscious. Probably every situation, in its totality and part

[1] The term 'unexpected' is frequently used in this sense. But it is also used in connexion with events or situations which are contrary to expectations, or frustrate expectations or merely conflict with previous experience, belief or knowledge. In view of its use in a number of senses, it has been excluded from the terminology used here. The term *non-expected* appears to be more suitable.

[2] Hitchcock, *op. cit.* pp. 62 sqq.

[3] Garnett, A. C., *Instinct and Personality*, p. 31.

totalities and its numerous elements,[1] leads to a vast number of perceptions and cognitions at various levels of consciousness, which are interpreted and assimilated so as to activate a large number of expectations according to which the experience of the individual in that situation will have its temporal development.

This possibility of the presence of a number of expectations at a given moment increases the complexity of the issue.

With the material available, it was possible in the first instance to answer the question regarding the presence of an expectation, only on the basis of the report of the subject on that question. When, however, this answer had been obtained from the given report, the introspective data and the knowledge of the situation and of the activity in which the subject was engaged at the moment of the stimulus were utilized to ascertain whether or not habitual or non-conscious expectations or other factors relevant to the problem were present. Any judgement in this connexion must be regarded as inferential and at times even speculative. Due allowance must be made for this.

Experiment VII. 'Introspections'

The relevant results from Exp. VII will be dealt with first.

Owing to exiguity of space the experiences are very briefly stated. The quantitative data, comprising S's estimates, of the consciousness, definiteness (or specificity) and certainty (or degree of belief) of expectation, and his estimate of the degree of surprise, are given in Table VII.

Out of the twenty-nine experiences given, in nine there was frustration of a present expectation.

PF (1). While entering a place where a dress-reform dinner was held S had a vague expectation regarding the nature of dresses he might see. He was surprised and disappointed to see 'a poor array of costumes'.

(4) S expected to get a book from a library. He was surprised to hear the attendant say that there was no copy of it.

(6) While driving a car S was surprised to see that a van which had dropped its back door had not stopped. He expected it to stop.

[1] Cf. Leibnitz's 'petite perceptions', which have, through their consequences, 'an influence greater than people think' (*The Monadology and other Philosophical Writings*, pp. 370 sqq.).

Table VII

		Expectation			Frustration (F) or Fulfilment (L) or Contrariness to Expectation (Con.)	Surprise
		Consciousness	Definiteness	Certainty		
PF	1	4	4	5	F	5
	2	3	3	5	F	9
	3	5	5	5	Con.	6
	4	3	3	6	F	5
	5	—	—	—	—	7
	6	3	3	6	F	6
PP	1	5	5	—	F	7
RS	1	10	10	10	L	10
	2	0	8	8	F	8
KU	1	2	2	10	F	9
	2	—	—	—	—	10
DM	1	3	3	8	F	7
	2	—	—	—	—	9
	3	—	—	—	—	3
	4	—	—	—	—	3
	5	—	—	—	—	7
	6	1	6	8	F	6
	7	3	4	3	F	4
MH	1	3	10	10	F	10
	2	—	—	—	—	10
	3	10	3	4	F	10
TR	1	—	—	—	—	9
SS	1	3	5	6	F	7
	2	2	4	5	F	9
	3	9	8	5	L	6
	4	7	8	9	F	6
	5	8	9	6	F	4
	6	9	9	7	L	9
	7	6	8	4	F	3

KU (1). While cycling S was expecting 'a narrow pathway to show up clear ahead of him' when his cycle lamp shone on something white. This caused surprise.

DM (6). S was coming out of a theatre. He was surprised to find himself walking straight on to the footpath of the main street when he 'had expected to have gone down a flight of stairs'. This expectation was, however, at a low degree of consciousness. S is certain that it never became focal in his consciousness.

(7) Looking at a map S expected to see the word 'Paddocks' and was surprised to find that the word was spelt as 'Paddox'.

SS (4). When S was engaged in work a friend entered her room and, fetching something, left without saying a word. S had expected that 'she would talk or say good-bye'.

(5) While writing a letter S was surprised to find that even after a long interval her 'style was still fresh and spontaneous'. She had expected to meet with some difficulty in finding words.

(7) S made a confidant of a lady and told her a private matter she had 'intended to tell none'. She had expected to keep the private matter to herself.

In the following eight cases, although conscious expectations were frustrated, non-conscious factors seem to be of importance in determining the surprise.

DM (1). S attempted to repair a torch but decided that the bulb was fused and that the torch, therefore, would not light. He put together again the parts of the torch which he had taken apart and pressed the switch to see if it moved freely when the torch 'came full on'. His expectation that the torch would not come on was low in consciousness and definiteness and this expectation was frustrated. It seems, however, that the belief regarding the incapacity of the torch to light had just sunk below the threshold of consciousness so that this may be considered as a border-line case in which the stimulus was somewhere between two types of stimuli—those which frustrate expectations and those which are merely non-expected. It is probable that the surprise was due to a conflict of the stimulus with S's non-conscious belief that the torch would not light.

PF (2). S was at a dress-reform dinner. His wife, who came in a little late, appeared angry and displeased with his costume. S vaguely expected that she would think his costume a success. He was surprised and annoyed at 'her unreasonableness and inability to enter into the situation'. In this case, although a conscious expectation is frustrated, the surprise does not seem to be wholly due to that frustration. More than her disapproval it was her 'unreasonableness and failure to enter into the situation' that was responsible for causing the surprise. This appears to involve a conflict of her reaction with S's knowledge of her. However, in view of his later statement that he believed he and his wife would never agree on these matters, it is not improbable that the surprise was due in part to the frustration of S's non-conscious expectation, regarding the reactions of his wife under similar situations, based on the ideal qualities which his own super-ego had ascribed to her. This inference receives some support from the fact that S regards the certainty of his expectation as 'irrationally high' and also, perhaps, from the fact that the degree of surprise was extremely high. It appears, therefore, that in this instance there was frustration of a conscious as well as a non-conscious expectation.

RS (2). S was 'expecting breakfast in the usual room. Found the

chimney being swept (in that room) and fire lit in another room'. S was 'not consciously expecting the breakfast in that room' but he thinks that his non-conscious expectation was 'very definite nevertheless'. A non-conscious expectation is here frustrated, but the surprise was probably due to the non-expected occurrence of the fact that the chimney was being swept. Perhaps the sweeping of the chimney conflicted with his habitual expectations regarding the state of the room.

PP (1). S was listening half-attentively to the talk of a child of nine who had received a letter and a booklet and was talking about them. He asked to see the booklet, expecting that 'it was a booklet illustrating the offices of a commercial firm'. Looking at it he realized that it was from a firm of bookmakers. This realization caused both surprise and pleasure.

It is doubtful if the surprise had anything to do with the frustration of the expectation. What was surprising was 'the discovery that a child of nine had written for and received circulars from a firm of bookmakers'. The stimulus to surprise was therefore non-expected. It can only be conjectured here that the non-conscious factor which determined the surprise was the conflict between the child's behaviour and S's knowledge or previous experience regarding the behaviour of children in general. But it appears that it was not merely this conflict that determined the surprise. The extraordinary nature of what the child did, rather than her mere failure to behave like a child, seems to be of particular importance.

MH (1). S was preoccupied with thoughts regarding a child she had just tested. She automatically pulled the handle of a door in order to open it and 'the handle came off without resistance'. S had 'expected the handle to be firm'. A conscious expectation is here frustrated. But it seems that there was also frustration of a non-conscious expectation for a certain amount of resistance (or for certain kinaesthetic sensations).

(3) S was testing a child and expected her 'to react normally' when the child had a 'jerking, grunting tic' which surprised S.

Although there is frustration of an expectation here, the non-expected nature of the stimulus seems to be significant. Probably the same degree of surprise would not have been caused if the child had reacted abnormally in some other way.

SS (1). S was walking in a library looking for a table to work at. At one of the tables marked 'Reserved for research students' S saw

a young lady whom she had seen before and whom she had 'associated with "Undergraduate Arts"'. The situation caused surprise. S had 'expected the table at which the young lady worked a free table where I should have sat and worked'.

There was frustration of expectation, but the surprise does not seem to be due to it to any considerable degree. It seems to have been caused by the non-expected nature of the stimulus at finding that particular lady occupying the table. Probably the fact that she worked at a table reserved for research students gave S the knowledge that she was a post-graduate student and this conflicted with her previous non-conscious belief that she was an undergraduate.

(2) S was sitting 'thinking of nothing in particular' and expecting to be asked 'a trivial question'. She was asked if she knew that 'Miss X had committed suicide'.

The fact that she was not asked a trival question does not seem to be responsible for the surprise which appears to have been caused by the nature of the question. It is difficult to say what non-conscious factors were concerned here. Perhaps the new fact conveyed to S by the question conflicted with her non-conscious beliefs, knowledge and expectations centred around Miss X.

Thus, out of the seventeen cases of frustration of expectations seen above, in eight cases the frustration was at the most partially responsible for the surprise which was determined rather by non-conscious factors.

In one case, PF (3), the stimulus was contrary to expectation. S was to meet a person he had never seen before and from the impression he had gathered about her he expected her to be 'an unattractive person'. He found her 'an extremely good-looking person, tastefully dressed, with a rather winning smile'.

In eight cases no expectation was present and the surprise seems to be connected with non-conscious factors.

PF (5). S was driving a car when a van passed him and as it did so 'there was a tremendous crash and the whole back-wall (or door) of the van fell into the road'.

It can only be conjectured in this case that the event conflicted with S's knowledge or experience regarding similar situations. The surprise does not seem to be due merely to the frustration of the non-conscious expectations activated by the situation in which S was just before the event. The nature of what occurred appears to be important.

KU (2). S was adjusting a friend's head for sketching when he noticed a net on his hair. On being asked about it, he lifted his 'hair off completely and left a head like a billiard ball'.

It is the nature of the stimulus that is important here. It seems to have conflicted with S's non-conscious knowledge or belief. He says: 'no expectation...you know a person's hair is a person's.'

DM (2). S lay back in a chair in a library 'half-asleep...quite lost to all around' him when he suddenly awoke because he had heard someone 'spitting loudly' which caused surprise. There was 'no expectation whatever' and the idea that 'spitting aloud' could not occur in a library 'was never conscious'. S 'only thought of it afterwards'.

There is no ground to believe that any non-conscious expectation existed in which 'spitting aloud' was associated with the library. Perhaps the stimulus conflicted with S's non-conscious belief concerning the behaviour of people in libraries.

(3) S was engaged in eating. A number of vague thought-processes were going on in his mind when he heard a knock at the door. This surprised him.

In this case it is extremely difficult even to conjecture what non-conscious factors led to the surprise. Perhaps the surprise was due to a disturbance in S's non-conscious expectations regarding the stimuli—in this case auditory stimuli—which he should receive under that particular setting. Or it may be that the knock conflicted with his previous experience and perhaps his habitual expectations regarding the absence of visitors at that hour.

(4) This experience was a continuation of the previous one. On hearing the knock S got up and proceeded towards the door 'wondering'. As he opened the door he saw a friend he had arranged to meet the next day. The recognition of the person surprised S. He had 'expected no one to be calling at all—consciously or sub-consciously'.

In this case it may be said that S had a non-conscious expectation in relation to meeting his friend the next day. The surprise may have been due to the stimulus conflicting with the place and time components of that expectation.

(5) S went to Glasgow where he knew no one. On his way, in the train, the fact that he knew no one in Glasgow had become explicit in his conversation. As S left the station and was walking down a street he was touched on the sleeve and on suddenly turning round he saw a person, B, whom he had met a few days ago. This caused surprise.

Immediately prior to the experience S was 'just vaguely wondering about an hotel and arrangements for the evening'. S says that he had an 'expectation' of 'meeting absolutely no person at all whom I knew'.

It is a question if the state described by S as an expectation above can be regarded as such. It seems to be a belief of S, that in Glasgow there was no one whom he knew, rather than an expectation. What occurred appears to have conflicted with, or disrupted that belief. In view of what S says regarding the contents of his mind immediately prior to the experience, it seems that even that belief had already become non-conscious although it was very near the threshold of consciousness. S's introspections indicate that the nature of the stimulus was important. He says that the surprise was doubly determined (i) by 'the state of mind I was in' and (ii) by meeting B.

MH (2). S was lying in bed in 'perfect tranquillity' when she remembered an appointment.

It is very difficult to conjecture what non-conscious factors were concerned here in the causation of surprise. Perhaps when S made the appointment she had an expectation of meeting the person, with whom the appointment was made, at a particular time and place. This expectation, in its non-conscious state, was frustrated when S remembered the appointment and realized the impossibility of fulfilling it. Or perhaps the thought that she had forgotten an appointment conflicted with her non-conscious belief regarding her own normal behaviour in connexion with keeping appointments.

TR (1). S was sitting in a café, watching people around him, when someone whom he thought he recognized as 'A' entered. This caused surprise. S knew that 'A' was not in the town in which he was, but this knowledge had not been conscious for a considerable time before the event.

The stimulus appears to have conflicted with S's non-conscious knowledge regarding the absence of 'A' from the town.

In three cases the stimulus fulfilled a present expectation and yet caused surprise.

RS (1). S was expecting his breakfast when together with his breakfast he received a 'letter from a friend after a long silence'.

The surprise here seems to have been determined by the incompatibility of the arrival of the letter with S's past experience regarding the receipt of letters from that particular friend.

SS (3). S was expecting to be asked 'something about a domestic

difficulty or perhaps the meaning of something wrong she had done' when she was told by her mother 'our neighbours are having a funeral and ought my mother to go over?'

Objectively considered, the expectation might be said to have been fulfilled since S was asked something about a 'domestic difficulty'. It is, however, the information conveyed by the question that caused the surprise. Perhaps the surprise was due to the conflict of the new fact or knowledge with S's non-conscious knowledge, beliefs or expectations regarding the neighbours.

(6) S said 'good-night' to a friend. The friend said 'good-night' and added S's first name, pronouncing it wrongly. He had never called S by her first name before. S had expected him 'to say good-night, shake hands and go'.

S's expectation was, partially at least, fulfilled. It is possible that the surprise was due to the incompatibility between her being called by her first name and her previous experience regarding the mode of address so far used by that particular friend. Moreover, the wrong pronunciation may have conflicted with her habitual experience regarding the pronunciation of her name.

Twenty-nine experiences have been analysed above. In seventeen of them it was found that a conscious expectation was frustrated. In eight of these, non-conscious factors also seemed at least partially responsible in causing surprise. In these cases frustration of non-conscious expectations or a conflict or incompatibility of the stimulus with S's non-conscious belief, knowledge or previous experience, seemed to be involved. These same non-conscious factors seem to be responsible for causing surprise in eight cases where no expectation existed and in the other eight experiences which made up the total of sixteen cases in which the stimulus was non-expected.

In four cases of frustration it was the nature of the stimulus rather than the frustration of expectation that was important in evoking surprise.

In one case the stimulus was contrary to expectation. In three experiences there was fulfilment of expectation, in two of which something non-expected occurred simultaneously with the fulfilment of expectation, while in one, what was expected was highly generic in nature. In the last case even though an expectation was fulfilled, in an objective sense, because the stimulus possessed the characteristics of the type of stimuli expected, surprise occurred.

Two principal conclusions can be legitimately drawn from these

data. First, a conscious expectation is not a necessary pre-condition for the occurrence of surprise. Surprise may occur when no expectation is reported or when the stimulus is non-expected. Secondly, surprise tends to occur when there is frustration of an expectation.

As for the cases in which the stimulus was non-expected, an attempt was made to analyse the non-conscious factors that may have been concerned in the causation of surprise. Such an analysis, however, can be only inferential and sometimes even conjectural or speculative. It indicated that where a stimulus is non-expected surprise may be caused by a conflict or a lack of compatibility between a presentation on the one hand, and, on the other, some non-conscious expectation, belief or knowledge or previous experience.

There is little that can be conclusively inferred from the quantitative data. Their utility is considerably diminished owing to the lack of comparability arising from the possible differences in the standards of valuation of the different subjects and the difficulty experienced by some subjects in separating the consciousness from the definiteness of the expectation. The data suggest that high degrees of surprise may be produced even when there is no conscious expectation (as in PF (5), RS (2), KU (2), DM (2) and (5), MH (2) and TR (1)). Also marked degrees of surprise may occur when the consciousness of expectation is low (as in PF (2), KU (1), DM (1) and (6), MH (1), SS (1) and (2)). There seems to be no special relationship between the degree of surprise and that of the consciousness, definiteness or certainty of expectation.

The relevant results from experiments in which the situation and the stimuli were constant for all subjects will be considered now. In some of these the conditions of the experiment were calculated to arouse marked and definite expectations. This minimized the difficulty of introspection and made the data relatively reliable even though most of the subjects were not trained introspectors.

Experiment V. 'Expectation'

In this experiment it will be recalled that S had just finished giving his introspections on an experiment in which he had observed. His mind was generally engaged in thoughts more or less connected with that experiment, or with the experimental situation, at the time when the stimulus (snap of fingers) was given. In every case the stimulus was non-expected. The ratings of the Ss for expectation and surprise are given below in Table VIII.

Table VIII

Subjects	Expectation			Surprise
	Consciousness	Definiteness	Certainty	
BC	—	—	—	3
BP	—	—	—	5
DL	—	—	—	6
GB	5	7·5	7·5	9
KT	—	—	—	8
MG	10	4	10	3
PL	—	—	—	3
RS	—	—	—	0
SL	4	2	1·5	6
TH	—	—	—	6

The stimulus caused surprise in nine out of ten Ss. In three of these an expectation was frustrated. The remaining six reported no expectation. GB expected E 'to move or shut up the book or something like that'. MG was 'expecting you would give me something else to do', while SL expected E 'to say something' regarding her reaction times (in Exp. III).

The introspections of the other six Ss, regarding their state of mind just before the stimulus, were as follows:

BC 'Vaguely wondering what would be next—not anticipating anything'. BP 'Just wondering what you were going to say'. DL 'I wasn't in a state of expecting anything—wondering'. KT 'No expectation'. PL 'Just wondering vaguely'. TH 'Thinking of the cards'.

In one S—RS—there was no surprise. He reported no expectation. This indicates that a non-expected stimulus may not be surprising in every case. The introspections of RS, who is a personal friend of E's, are of special interest. With reference to the stimulus he says, 'I thought it was a signal it was all over—if you were a stranger probably I would have been shocked'. The meaning of the stimulus was thus determined in the light of S's relationship to E. The stimulus was immediately interpreted and assimilated as a signal that all was over. It fitted within a comprehensive configuration regarding the type of behaviour of friends in general. E's behaviour was cognized as compatible with S's knowledge or previous experience in relation to a class of individuals. May it be inferred that in cases where surprise was caused the stimulus conflicted with or was incompatible with S's knowledge or previous experience of the behaviour of individuals in general? Such an inference does not appear to be entirely groundless. If this inference is correct, then it would seem that in

all Ss non-conscious factors were more important in the causation of surprise than the frustration of conscious expectations. The case of MG gives further support to this view. In that S the degree of surprise was low even though a conscious expectation of a marked intensity was frustrated. The explanation seems to be similar to that in the case of RS. MG is also E's friend. This fact must have reduced the degree of conflict or incompatibility between E's unconventional behaviour and S's non-conscious knowledge, beliefs or experience regarding the behaviour of individuals in general, so that one factor, which probably reinforced the intensity of surprise in other Ss, was not fully operative here.

These data support the principal conclusions arrived at from the results of Exp. VII, viz. (1) conscious expectation is not a necessary pre-condition for the occurrence of surprise and (2) surprise tends to occur when there is frustration of an expectation. The influence of non-conscious factors in the causation of surprise is again indicated. The quantitative data confirm the conclusion that high degrees of surprise can occur even when there is no conscious expectation.

Experiment VI. 'Jokes'

The data from Exp. VI will be examined now.

The relevant results connected with Cards VI, VII and VIII[1] are considered in relation to each card. The quantitative data are given in Table IX.

Card VI

All Ss, except CH and MN, reported surprise.

There was frustration of one or more expectations in thirteen Ss. Of these, in five (AT, MT, RM, SK and ST) an expectation for a 'longer joke' or a similar expectation was frustrated. AH had expected the words 'and in some cases it is better removed'. In two Ss there was another expectation in addition to the one for a longer joke. BE expected 'a scientific joke—something about appendicitis', while TW expected 'a joke about the appendix'. In UG and WL, who also expected a longer joke, the nature of the stimulus seemed to be at least partly responsible for the surprise. UG says, 'I never expected "brain" to follow.' WL 'didn't expect the result to be what it was'. In MM there was a conscious expectation for a scientific joke, but it is possible that there was also a non-conscious expectation for a longer

[1] The contents of the cards are given in Chapter II, p. 42.

Table IX

	Card VI			Card VII			Card VIII		
Ss	Expectation		Surprise	Expectation		Surprise	Expectation		Surprise
AH	8	F	5	4 and 4	F	6	—		0
AK	—		8	9	F	10	9	F	10
AT	7	F	5	10 and 10	F	10	7	L	3·5
BE	10 and 10	F	5	10 and 10	F	10	—		5
BN	6	F	7	9	F	9	8	L	7
BT	5 and 10	F	4	10 and 10	F	7	—		6
CH	10	L	0	7	F	9	10	L	0
HL	8	L	6	9 and 9	F	10	6	F	7
LP	—		7	5	F	6	8	F	10
MM	2	F	6	10 and 10	F	10	—		5
MN	10	L	0	5	F	10	9	L	0
MT	10	F	6	10 and 8	F	10	10	F	5
PS	4	L	5·5	10	F	8·5	—		0
RM	3	F	2	5	F	5	8	F	2
RN	—		5	10 and 10	F	10	—		5
SK	9	F	8	10	F	9	10	F	10
SR	—		4	8	F	10	7	F	5
ST	10	F	3	10	F	5	10	F	7
TW	8 and 10	F	3	9 and 9	F	8	10	F	7
UG	7	F	8·5	9·5	F	8·5	1	F	1
WL	9·5	F	10	7·5	F	7	9	F	7

F, frustration; L, fulfilment.

joke. S says that she was surprised when she 'saw it was short'. In BN the surprise was 'due to (i) unscientific ending and (ii) in just two words'. S had expected 'the whole of the back to be covered with writing'. The stimulus was thus contrary to expectation. But, in addition, there seems to have been frustration of a non-conscious expectation for a scientific ending, set up by the apparently scientific nature of the statement on the first side of the card. BT had two expectations. He 'thought it would go on about the appendix', and also expected 'lots more words'. These expectations were frustrated. In view of the second expectation the stimulus, which comprised only two words, might be regarded as contrary to expectation.

In four Ss expectations were fulfilled. In two of these (CH and MN), who fully expected the word 'brain', there was no surprise. HL expected 'the joke to continue on some other part of the body' but had 'no idea it would be the brain'. Here, the nature of what was expected was so generic that even though, objectively speaking, the stimulus bore the characteristics of the class of stimuli expected and thus, in a sense, fulfilled the expectation, yet it caused surprise. Perhaps the reason why surprise occurred was that the brain appeared in a context in which its meaning was in violent opposition to that which S was accustomed to ascribe to it.

PS expected 'something high-sounding, and it turned out to be so'.

This case is similar to the previous one. S was surprised because he 'didn't expect the brain'. Here again, as in HL, what was expected was highly generic.

No expectation was reported by four Ss (AK, LP, RN and SR). In the first three of these, the introspections indicate that probably a non-conscious expectation was frustrated. AK was 'surprised that it was shorter than most'. LP says, 'I suppose subconsciously I was expecting the joke to be longer, if subconscious expectation is possible.' RN 'didn't expect the ending to be so short'. In SR, there is nothing in the introspections to point to any definite non-conscious factors. It can only be conjectured, on the basis of the introspections of other Ss, that the surprise was due perhaps to the frustration of a non-conscious expectation for a longer joke or to the occurrence of the word 'brain' in an entirely new context.

Thus in thirteen Ss there was frustration of one or more expectations. Of these, in two there was an indication that non-conscious expectations were frustrated as well and in four the nature of the non-expected stimulus seemed important in causing surprise. In two cases the stimulus was contrary to expectation. In four Ss there was fulfilment of an expectation. In two of these, who precisely expected what was to come, there was no surprise. In the other two, the expectations fulfilled were highly generic. Four Ss reported no expectation. In three of these there are indications that non-conscious expectations were frustrated. In one S it can only be conjectured that the non-conscious factors responsible for surprise were similar to those which were conscious in others.

Card VII

In all Ss there was frustration of at least one expectation and all Ss reported surprise.

In thirteen Ss an expectation for the words 'no longer' was frustrated. In eight of these another expectation was frustrated as well. AH expected 'the men either to leave the club or to try and shut the man up'. But besides the frustration of the two expectations reported, the surprise seems to be at least partly due to the non-expected nature of the stimulus as is indicated by S's statement that 'it was an unexpected finish'. AT expected 'the page to be full of typewritten matter', BT expected 'more writing'. BE, MM and ST expected American type of joke. RN expected a cutting remark and MT 'that a member of the club was going to get the best of it with a taller

story'. Of the remaining five in whom an expectation for the words 'no longer' was frustrated, in CH it appears to be the only one but in BN and MN the surprise seems to be due, not to the frustration of this expectation but to that of a non-conscious expectation for a complete joke. BN said, 'Quite unconsciously assumed that the joke will be completed', while MN had 'sort of unconscious expectation that the other man would say something'. In AK and UG the nature of the non-expected stimulus may have been important in causing surprise. AK says, 'Turned over and found the hieroglyphics' and UG was surprised when he 'didn't find the words and found the symbol'.

Although in MM two expectations were frustrated, the nature of the stimulus also seems important in causing the surprise. She said, 'It's more surprising than to find a blank card.'

In six Ss an expectation for an American type of joke was frustrated. In HL and TW there was also frustration of an expectation for 'more writing'. SR remarked, 'There's nothing on the back of that'. Apparently the figure and the letter fell into the category of 'nothing' because S had non-consciously expected to find something meaningful in relation to a joke. TW was also surprised 'to find nothing on the other side', while WL was surprised when he 'saw what was on the other side'. In the last three Ss a non-conscious expectation for a joke is likely to have been frustrated and in WL the nature of the stimulus also seems important in causing the surprise.

SK expected 'continuation of the story'. He was surprised 'when the story was not finished and the square and "A" appeared'. In this S also the nature of the stimulus is important.

LP 'half expected that I should see nothing on the other side' because he thought that the joke was complete on the first side of the card. S's introspection shows that by 'nothing' he meant a blank and not something unrelated to the matter on the first side, since he thought the joke may have been complete before he turned over. The surprise may have been due partly to the frustration of this expectation as something did appear, and partly perhaps to S's non-conscious expectation to find some typewritten matter on the other side. The relatively low degree of surprise, as compared with the surprise in other Ss, may be due to the absence of frustration of a non-conscious expectation for a joke.

Thus, there was frustration of one or more expectations in every S. In six Ss a non-conscious expectation seemed to be frustrated as well.

In two of these the frustration of a non-conscious expectation appeared to be responsible for the surprise to a greater degree than the frustration of conscious expectations. In six Ss the nature of the non-expected stimulus also seemed important. In these cases it is probable that the surprise was due, in part, to the appearance of familiar objects in a connexion in which they had never appeared before.

Card VIII

In eleven Ss an expectation was frustrated. All these reported surprise. In eight of these (AK, LP, MT, RM, SR, ST, TW and WL) there was an expectation for the joke to be completed. SK 'definitely expected a joke', while UG had a very vague expectation regarding 'some remarks or a question from a friend'.

In four Ss an expectation was fulfilled. In two of these (CH and MN) there was no surprise. CH expected 'it to be a blank because I had the last one in my mind and because there was a full-stop and it seemed there was nothing else that could be said'. MN 'expected it would be a blank, but was ready for something if it was there'.[1] AT 'expected the joke not to finish properly'. If this is regarded as an expectation that something unconnected with the joke would appear on the other side, then there is fulfilment of an expectation in a sense. In that case the thing that appeared—a blank—may be said to have failed to fall within the class of presentations covered by the expectation, even though, objectively considered, it belonged to the class of unconnected presentations. The expectation may be then regarded as highly generic. In view of S's statement that he was surprised because 'there was no end', probably a non-conscious expectation for something on the other side of the card was frustrated. BN's case is similar. He says, 'After the other one I more or less expected something queer on the back.' The expectation can be regarded as fulfilled if the term 'queer' is considered as covering everything unrelated to the matter on the first side of the card, so that, objectively considered, the blank falls within the class of 'queer' presentations. There seems to be, however, frustration of a non-conscious expectation for something to appear. S says, 'I didn't expect it to be just a blank. I was surprised when I found it a blank.'

[1] This is an interesting case of a dual attitude towards the coming event. It helps to distinguish between expectation and readiness or preparedness, a belief in the occurrence of a particular event being necessary for the former but not for the latter. One can be prepared to receive an impression *in case it appears*, without expecting it to appear.

Six Ss reported no expectation, in two of whom (AH and PS) there was no surprise. In the other four there are indications that non-conscious expectations were frustrated. BE was surprised 'to see nothing'; BT says, 'Rather unexpected—an ending like that. I thought there would be a bit more to it.' RN 'thought the joke would go on'. MM's introspections are of particular interest. She was 'quite hopeful to find an end of the joke' but expected nothing. 'Was prepared to be pricked again but I wasn't certain. I thought quite probably it would be a normal joke again.' S had therefore a dual attitude (or perhaps a vascillating one) in relation to what was to come. It is, however, probable that the predominating mental content was a non-conscious expectation for the completion of the joke and that this expectation was frustrated. S says, 'Turned over and said "O! blank again"', which indicates that she believed the joke would be completed.

Thus, eleven Ss whose expectations were frustrated reported surprise. In four Ss there was fulfilment of expectation. In two of these, whose expectation corresponded precisely to the stimulus, there was no surprise. The other two reported surprise. Their expectations were highly generic in nature. Six Ss reported no expectation. In two of these there was no surprise. In the remaining four, for whom the stimulus was non-expected, there were indications of the frustration of non-conscious expectations.

Considering the data derived from Exp. VI all together, it can be seen that surprise was experienced in all but six of the sixty-three cases.

In forty-five cases there was frustration of expectation. In eight of these, non-conscious expectations also seemed to have been frustrated, and in two cases the frustration of non-conscious expectations seemed more important in causing surprise than that of conscious ones. In two cases the stimulus was also contrary to expectation.

In eight cases an expectation was fulfilled. In four of these, in which expectations were highly generic in nature, surprise was reported.

In ten cases no expectation was reported. In two of these surprise was not experienced even though the stimulus was non-expected. These cases, like that of RS in Exp. V, indicate that every non-expected stimulus need not cause surprise.

In ten Ss the nature of the stimulus seemed important in causing surprise.

These data substantiate the principal conclusions arrived at in Exps. VII and V. They show that a conscious expectation is not a necessary pre-condition for the occurrence of surprise and that the frustration of an expectation tends to cause surprise.

The knowledge of the conditions of the experiment and of the stimulus, and more particularly the introspective records of the subjects supply some justification for the inference that in some cases in which the stimulus was non-expected there was a probability of a non-conscious expectation having been frustrated. Making allowance for the inferential nature of it, the conclusion may be drawn that surprise is caused if a non-conscious expectation is frustrated.

There is a further conclusion which can be drawn although it is based only on a few cases. A stimulus fails to evoke surprise if it corresponds precisely to what is expected, i.e. fulfils an expectation. But when what is expected is highly generic, the stimulus may evoke surprise even though, objectively speaking, it fulfils the expectation by possessing the characteristics of the class of stimuli expected.

The quantitative data indicate that when an expectation has a very high degree of specificity and belief, its frustration is likely to cause marked degrees of surprise. However, this must be regarded only as a tendency and a sweeping generalization is not justifiable. It has been observed that in some cases the nature of the stimulus and non-conscious factors contributed to the causation of surprise so that the high degrees of surprise cannot be entirely attributed to the frustration of conscious expectations. Further, in some instances at least, the degree of surprise is not proportional to the certainty of the expectations frustrated (Card VI, BE, BT, ST and TW; Card VII, ST; Card VIII, MT and RM).

Some of the data connected with Cards VI and VIII show that considerable degrees of surprise may occur even when there is no expectation or when the degree of belief in the expectation is low (e.g. Card VI, AK, LP, MM and RN, and Card VIII, BE, BT, MM and RN).

It remains now to see what knowledge can be gained from Exps. I, II and IV. In these experiments the Ss were not trained introspectors, so that detailed introspections are not available. Yet the introspections, together with the knowledge of the situation and the stimuli, are sufficient to indicate certain conclusions.

In Exp. I—'Cards and Animals'—frustration of an expectation was involved in all cases. The stimulus was non-expected and the

nature of it—that it was a toy animal—seemed to be important although the frustration of the expectation for 'a number' was at least partly responsible for the surprise.

In every case only the first animal caused surprise. The introspections of many Ss indicate that after the first animal there was an expectation for similar stimuli,[1] although the expectation was not focal in every case. From this, one can conclude that where a stimulus corresponds to what is expected it fails to evoke surprise.

In Exp. II—'Tapping and Light'—S was absorbed in tapping and his expectations, if any, may be said to centre around that activity at the time of the stimulus. The stimulus was therefore non-expected.

In this case what non-conscious factors were concerned is a matter of conjecture. It is not improbable that the sudden plunging of the room into darkness conflicted with, or was incompatible with, S's previous experience of similar situations.

There was no surprise for the second or subsequent repetitions of the stimulus. The introspections of some of the subjects show that an expectation for repetitions of the stimulus was set up by the occurrence of it the first time.[2] E.g. PR says: 'I expected it to happen in the later ones.' Or MC: 'I expected it to go out.'

The results of this experiment, therefore, confirm the conclusion that when a stimulus corresponds precisely to what is expected it fails to evoke surprise.

In Exp. IV—'Masks'—the most marked degrees of surprise were produced by the first mask. But in some Ss some of the later masks also produced surprise. Even though all the stimuli after the first one fell within the class of stimuli expected, they caused surprise because what was expected was not specific enough. Even then the expectation was responsible for a diminution in the degree of surprise aroused.

If this experiment is considered in connexion with Exp. I, it is suggested that in this case surprise was caused in some cases by a series of similar stimuli because the stimuli were unfamiliar or unknown to most of the subjects. This is indicated by the fact that in Exp. I,

[1] E.g.: 'Only the first animal caused surprise. After that I expected to see some animals.' 'When I had one animal I quite expected another.' 'Surprise for first animal, not for others, because they are of the same type.'

[2] It is interesting to compare this establishment of an expectation by a single occurrence with the similar establishment of a motor set which Flügel and McDougall observed in their experiment with lifted weights ('Some observations on psychological contrast', *Brit. J. Psychol.* vol. VII, p. 354, 1914).

in which the stimuli represented familiar animals, no surprise was evoked by any of them except the first one, even though, relatively speaking, the stimuli were as divergent within the class to which they belonged as the masks. This points to the importance of the nature of the stimulus in causing surprise in some cases. It may be said, perhaps, to indicate that knowledge of stimuli (as distinct from any specific expectation for them) facilitates immediate assimilation and reduces the possibility of the occurrence of surprise, while lack of such knowledge conduces to the experience of surprise.

Conclusions

The following conclusions emerge from the experimental investigations of the problem of the relationship of surprise to expectation:

(1) A conscious expectation is not a necessary pre-condition for the occurrence of surprise.

(2) Surprise tends to occur when a conscious expectation is frustrated. There are indications that it also tends to occur when a non-conscious expectation is frustrated.

(3) In some cases it is the nature of the experience rather than the frustration of an expectation that is important in causing surprise.

(4) A stimulus fails to evoke surprise if it corresponds precisely to what is expected, i.e. fulfils an expectation. But when what is expected is highly generic in its nature the stimulus may cause surprise even though, objectively speaking, it fulfils the expectation by possessing the characteristics of the class of stimuli expected. This seems to be particularly the case where the stimuli are relatively unfamiliar or unknown.

(5) Not every non-expected stimulus is surprising.

In cases where the stimulus is non-expected there are indications that surprise is caused when there is a conflict or incompatibility between the presentation on the one hand, and on the other, some non-conscious expectation, knowledge or belief or previous experience.

To conclude this chapter with a brief theoretical discussion on the stimulus of surprise, it seems that there is no ground for the belief that surprise can occur only when the stimulus is contrary to expectation or frustrates expectation. It has been seen how frequently surprise can occur when there is no expectation and when the stimulus is non-expected. Nor is novelty an indispensable characteristic of the stimulus of surprise, although the new may arouse surprise. In

many cases surprise occurs because a present expectation is frustrated and the importance of the nature of what frustrated the expectation is negligible. It seems, however, that owing to the difficulties involved in precisely determining the connotations of the terms 'knowledge' and 'newness' sufficient importance is not attached to the role of new cognitions in the causation of surprise. In many cases where *familiar objects* are supposed to cause surprise because they appear 'unexpectedly' the emphasis is wrongly placed on the 'familiarity' or 'knowledge' of the object. What causes surprise in these cases is the appearance of such objects in hitherto uncognized relationships. In a situation in which every element is *known*, surprise may occur because of the new configuration in which the elements are moulded, or because of the hitherto uncognized relationships in which they occur. Thus 'newness' of relationships, if not of 'objects', does seem to play a more important role in the causation of surprise than what some psychologists are inclined to ascribe to it.

To venture an opinion regarding the causation of surprise, it might be said that surprise tends to occur when an expectation (conscious or non-conscious) is frustrated or when the stimulus conflicts with or is incompatible with previous knowledge, belief or experience.

CHAPTER VIII

SURPRISE AND LAUGHTER

Surprise has figured prominently in connexion with theories of laughter. In the historical survey it was seen that considerable importance has been attached to surprise in the genesis of laughter. The problem of the relationship of surprise to laughter, therefore, seems to be an important one. Since, however, the problem of laughter itself has proved to be highly controversial, it would have been too ambitious a task to attempt in this present study an exhaustive investigation of the relationship of surprise to a reaction which has so far refused to divulge its precise nature in the face of penetrating attacks on the part of psychologists. But, as no experimental investigation of the problem has been undertaken so far, it was thought that a preliminary study of it might prove to be of some utility.

As in the study of the relationship of surprise to expectation, the data for the study of the present problem are derived from almost the whole range of the experiments. In Exp. VI ('Jokes') this problem was the principal one investigated. In Exp. V the reactions of S were observed in the light of this problem, while Exp. VII has again supplied some valuable data. As for the other experiments, although no great importance can be attached to them in this connexion, they provide some useful supplementary material.

Experiment VI. 'Jokes'

It will be recalled that in this experiment S was given six cards to read.[1] For each card E obtained S's estimates of his amusement and surprise. Further, E observed S's reactions and classified them for laughter under the following heads: (1) nil; (2) slight smile;[2] (3) considerable smile; (4) broad smile; (5) slight laughter; (6) considerable laughter; (7) profuse laughter.[3]

The results are given in Tables X and XI.

In dealing with the results attention will be focused on the fre-

[1] See Chapter II, p. 41.

[2] For the purposes of this experiment at least the writer feels justified in regarding the smile and laughter as the same reaction at varying degrees of intensity.

[3] In tabulating the results these reactions have been assigned the numerical values of 0, 1, 2, 3, 5, 8, and 10 respectively.

quencies of the reactions rather than on their intensities. The latter can, at best, be regarded as of secondary importance in view of the probability that in the estimates of amusement and surprise each S may have had a varying standard of evaluation which would render any comparison between different Ss unjustifiable, and even for the same S far from exact.

In considering the association of surprise with laughter 'amusement' has had to be regarded as implicit laughter for the purposes of this experiment, even though it is fully realized that amusement must be considered as a mental state which goes with only a particular type

Table X

	I	II	III	IV	V	VI	VII	VIII	Total no. of cases
Surprise with laughter	1	4	2	6	5	8	14	4	44
Surprise with amusement	4	7	3	8	9	17	10	9	67
Surprise without laughter	4	8	2	3	5	11	7	13	53
Surprise without amusement	1	5	1	1	1	2	11	8	30
Laughter without surprise	6	2	11	10	8	2	0	1	40
Amusement without surprise	13	6	16	9	10	2	0	0	56
Surprise without laughter or amusement	1	5	1	0	1	1	5	8	22
Laughter without surprise or amusement	0	0	0	1	0	0	0	1	2
Amusement without surprise or laughter	7	4	5	0	2	0	0	0	18
Surprise with amusement, without laughter	3	3	1	2	4	10	2	5	30
Surprise with laughter, without amusement	0	0	0	1	0	1	6	0	8
Amusement or laughter without surprise	13	6	16	10	10	2	0	1	58
Laughter without amusement	0	0	0	2	0	1	6	1	10
Amusement without laughter	10	6	5	3	6	9	2	4	45
No reaction	3	3	1	2	1	0	0	3	13

of laughter and is by no means invariably associated with that reaction. This procedure is justified by a number of reasons. First, there is the possibility of error in observation on the part of E who may fail to observe very slight facial changes. Secondly, there is a habitual tendency to associate laughter with amusement, which tendency may lead S to give 'amusement' as his reaction when he probably means only 'a tendency to laugh' or 'felt like laughing'. Thirdly, although all laughter does not have amusement as its emotional concomitant, it will not be wrong to assume that all amusement tends to express itself in laughter so that if Ss report amusement without registering laughter it will be allowable to regard amusement as implicit laughter and to attribute the failure of its expression

Table XI

Letters A, S and L stand for amusement, surprise and laughter, respectively

Cards ...	I			II			III			IV			V			VI			VII			VIII			Frequencies of			Total values of		
Subjects	A	S	L	A	S	L	A	S	L	A	S	L	A	S	L	A	S	L	A	S	L	A	S	L	A	S	L	A	S	L
AH	2	1	0	6	0	0	7	3	1	4	1	0	6	3	0	3	5	0	3	6	0	0	0	0	7	6	1	29	19	1
AK	1·5	0	0	0	3·5	0	2·5	3	0	1	1·5	0	4·5	3	0	3	8	0	0	10	1	0	10	0	5	7	1	12·5	39	1
AT	4	0	0	9	0	5	6	0	0	9	0	5	5	0	5	2	5	0	0	10	0	4	3·5	0	7	3	3	39	18·5	15
BE	0	5	0	0	4	0	7	0	8	5	3	8	4	3	5	3	5	0	9	10	5	0	5	0	5	7	4	28	35	21
BN	3	2	0	6	2	1	7	4	1	4	2	1	5	2	0	8	7	0	2	9	0	3	7	0	8	8	3	38	35	3
BT	4	0	0	2	5	0	7	0	5	7	4	10	3	0	0	3·5	4	0	1·5	7	5	5	6	5	8	5	4	33	26	25
CH	3	0	1	5	0	0	7	0	5	2	0	1	5	0	5	6	0	3	0	9	5	0	0	1	6	1	7	28	9	21
HL	1	0	0	2	5	0	2	0	5	4	0	5	5	4	8	1	6	1	9	10	8	2	7	0	8	5	5	26	32	27
LP	6	0	8	4	8	1	8	0	10	7	0	10	6	0	5	2	7	1	3	6	1	0	10	0	7	4	7	36	31	36
MM	1	0	0	3·5	3	5	5	0	8	6	1	5	5	1	8	6	6	5	5	10	8	6	5·5	8	8	6	7	37·5	26·5	47
MN	0	0	0	0	0	0	2	0	0	4	0	1	3	0	0	5	0	5	0	10	5	0	0	0	4	1	3	14	10	11
MT	5	0	8	4	0	0	4	0	0	5	1	5	5	1	0	4	4·5	0	5	10	5	3	5	5	8	5	4	35	21·5	23
PS	8	0	1	0	4·5	0	10	0	1	0	0	0	2·5	0	1	4·5	5·5	0	0	8·5	0	0	0	0	4	3	3	25	18·5	3
RM	0	0	0	2	0	0	2	0	0	0	0	1	4	0	1	6	2	1	0	5	2	0	2	0	4	3	4	14	9	5
RN	2	0	1	0	2	0	1	0	1	0	2	1	0	6	0	0	5	1	5	10	5	0	5	0	3	6	5	3	30	9
SK	2	0	0	0	0	0	5	0	0	7	0	1	9	0	5	0	8	0	0	9	0	0	10	0	4	3	2	23	27	6
SR	4	1	5	6	0	8	2	0	5	4	0	5	7	2	8	7	4	8	0	10	5	0	5	0	6	5	7	30	22	44
ST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	1	0	8	1	3	7	0	2	3	2	6	18	2
TW	6	0	8	5	3	5	8	0	10	8	0	10	2	0	8	6	3	0	0	8	0	2	7	5	7	4	6	37	21	46
UG	1	2	0	1	3	0	0	5	0	6	4	0	8	6	5	8	9	0	0	9	0	1	1	0	6	8	1	25	39	5
WL	2	0	0	0	8	0	8	0	5	5·5	0	5	6·5	0	5	7	10	8	4·5	7	5	0	7	0	6	4	5	33·5	22	28
Total values	55·5	11	32	55·5	51	25	100·5	15	65	88·5	19·5	74	95·5	31	69	88	107	34	47	181·5	61	29	103	24	123	97	84			
No. of cases	17	5	7	13	12	6	19	4	13	17	9	16	19	10	13	19	19	10	10	21	14	9	17	5						

through facial changes to individual differences.[1] Further, the degree of amusement may be too low to demand motor expression through facial changes even when a subject easily expresses his amusement through laughter. Therefore, in all cases where a subject has reported amusement it will be assumed that a tendency to laugh existed.

To proceed to examine the results, a glance at Table X shows that surprise is not invariably associated with amusement or laughter. Out of a total of 168 cases there are fifty-three in which surprise has occurred without laughter, thirty when it has occurred without amusement and twenty-two in which it has been associated neither with amusement nor laughter. Further, there are fifty-six cases in which amusement has been reported without surprise and there are forty cases of laughter without surprise. These cases show that there is no invariable association between surprise and amusement or laughter.

There are, however, a large number of instances in which surprise has been associated with amusement or laughter. It occurred with laughter in forty-four cases and with amusement in sixty-seven cases.

The cases in which surprise occurred, with or without amusement or laughter, will be examined now.

Each card will be dealt with individually in order that relevant introspective data may be conveniently presented with reference to their contexts.

Card I caused surprise in five Ss. In three of these (AH, BN and UG) it was connected with low degrees of amusement and no laughter, in one (SR) there was some amusement as well as slight laughter and in one (BE) there was neither amusement nor laughter.

BE thought that the matter on the two sides of the card had no relationship and that 'something was missing'. Apparently his surprise was due to his failure to find a joke.

SR was surprised that the joke was on two sides. His surprise was therefore not connected with something in the joke itself.

AH, BN and UG had no expectation in relation to the nature of the joke. Yet, both the surprise and the amusement have low values. It may be observed that BN and UG have reported surprise for every card.

[1] Although little importance can be attached to the quantitative values for purposes of comparison, on working out the coefficient of correlation between amusement and laughter it was found to possess the value of 0·62 with P.E. 0·093. The individual differences in the ease with which Ss express their amusement through laughter and the degree of laughter which they indulge in, can be seen from Table XI.

Card II produced surprise in twelve Ss. Five of these (AK, BE, PS, RN and WL) reported no amusement and registered no laughter.

All Ss who were surprised failed to see the point of the joke at the first reading and some of them never saw it till they were told. In all of them the first sentence stirred up expectations regarding a joke referring to sexual matters. It seems, therefore, that what came on the other side of the card failed to fit into the configuration activated.

In the five Ss who did not laugh or experience amusement, the failure to understand the joke led to emotions like perplexity and irritation following on surprise.

Of the remaining seven Ss who were surprised, BN, HL, MM and TW grasped the point of the joke at the second or third reading and the amusement or laughter followed on their seeing the joke while BT, LP and UG failed to understand it altogether.

BT asked E, 'Is there anything subtle about the joke or am I being dense?' LP reported that 'what mirth it did provoke was at the grotesque nature of the reply'. He added, 'I haven't quite seen it.' UG was surprised because the hearer 'said nothing....I thought it meant that he said "very dull" or the hearer did not attach any importance to it'.

Thus in LP and UG an attempt seems to have been made to extract a joke out of the situation. But in LP as well as BT there is an awareness of a failure to understand the joke.

In five Ss, therefore, there was no amusement or laughter connected with surprise when they failed to get the point of the joke and were puzzled about it. Amusement or laughter followed in four Ss only when they had seen the joke and in two more when the Ss extracted a joke out of what was given in view of their expectation for a joke. In two (BT and LP) the amusement appears to be related to the awareness that they had failed to understand the joke.

For Card III four Ss reported surprise of whom UG did not express amusement or laughter while AH, AK and BN did so. These three Ss had fully expected the type of the joke that was coming. UG failed to understand the joke. He turned the card over twice and looked puzzled. He said, 'I couldn't understand the sense of "fumbling for the keyhole"....I only realized the man's helplessness.'

Thus amusement or laughter was caused in those Ss who understood the joke, but not in UG even though he was surprised.

Card IV caused surprise in nine Ss (AH, AK, BE, BN, BT, MM, MT, RN and UG). Every S except UG had expected the joke to be

a 'type' joke but were surprised at the particular ending which came. UG again failed to understand the joke but was amused at the thought that 'the man was drunk and still wanted some more whisky', hence 'he had no time to wash with water'. Every S therefore found in the stimulus something 'worth while' for his reaction of amusement.

Card V aroused surprise in ten Ss (AH, AK, BE, BN, HL, MM, MT, RN, SR and UG) all of whom, except RN, reacted with amusement or laughter.

RN reported disappointment and his surprise was due to 'the fact that he didn't say anything more when he could have said such a lot more'.

All Ss except SR and UG expected the type of the joke—that it would be regarding Cuthbert's brains. In AH, BE, MM and MT the amusement commenced at reading the name Cuthbert. UG was amused and laughed at the 'silliness of the questioner'.

All Ss except RN, therefore, found in the stimulus something 'worth while' for their reaction of amusement or laughter. RN, who did not, reacted with disappointment following surprise.

Card VI caused surprise in nineteen Ss all of whom, except SK, reacted with amusement or laughter. In seven of these (AK, AT, MT, RM, RN, SK and ST) the surprise appeared to have been related to the shortness of the joke rather than to the nature of it, in seven more Ss (BE, BN, BT, MM, TW, UG and WL) the nature of the joke also seemed important, while in AH, HL, LP, PS and SR the surprise seemed to be due more to the nature of the joke than anything else.

SK failed to perceive any joke. He regarded 'the statement from the scientific point of view'.

BE and BT had to turn the card over twice before they understood the joke and the amusement followed on their grasping the joke. HL thought of the brain in terms of its physiological function of integration and not as 'the organ of intelligence'. His amusement and laughter have very low values, although his surprise was considerable. Similarly in LP the surprise is considerable but the laughter and amusement values are very low because S did not think the joke to be 'awfully funny'. MM whom the joke 'struck as rather apt', RM who found it 'clever', and ST who 'liked the big way the words went', each responded with relatively considerable amount of reaction. These cases, together with those of BE, BT, HL and LP, indicate that the reaction depended predominantly on the appreciation of the joke.

AH was amused at himself for expecting a different end; MT was 'amused both at the joke and at having been taken in'; and WL reported 'a shock overcome by laughter'. In these cases it appears that a feeling of inferiority or a negative self-feeling following on surprise was connected with laughter.

Card VII caused surprise in all Ss. In five of these (AT, PS, SK, TW and UG) there was neither amusement nor laughter; AT, TW and UG attempted to interpret the figure and the letter so as to obtain a joke. PS and UG asked E what the 'symbols' meant while TW concluded that they meant nothing. AT and SK expressed puzzlement.

Of the remaining sixteen Ss twelve reported feelings of the nature of negative self-feeling, aptly described by some Ss as a 'feeling of being had'. In WL 'the amusement was derived from imagery connected with the American—the laughter at being had'.

The four Ss who did not report a feeling of 'being had' or similar feelings all expressed curiosity and attempted to make some meaning out of the symbols. AH said, 'It was the unexpectedness that amused me'. RM looked at E and said, 'Can't understand it.' It is not improbable that in these Ss too a negative self-feeling was generated.

It is significant that in Card VII, which contained no joke, there are five cases where no laughter or amusement occurred and six in which laughter occurred without amusement. Further, the reports of Ss indicate that where 'amusement' occurred it was a different experience from that which occurred in relation to completed jokes which were appreciated as such. A 'feeling of being had' or a negative self-feeling was associated with the laughter.

The emotional concomitant of laughter which occurred in relation to Card VII was, therefore, not the same as that which occurred in relation to other cards the contents of which were cognized as amusing.

Card VIII caused surprise in seventeen Ss. In eight of these (AK, BE, LP, RM, RN, SK, SR and WL) there was neither amusement nor laughter.

Out of the nine Ss who reacted with amusement or laughter or both, in five a negative self-feeling was reported.

BN said, 'Different sort of amusement again—frustrated feeling which amused me I think', HL, 'The joke is on me', MM reported 'a sense of frustration', MT 'turned over and found it a hoax again', and ST 'smiled because I found I was done again'.

There are indications that similar feelings were experienced by AT

and BT. The former was 'amused to see the joke not finished', while BT continued turning the card over and over again and was 'amused at the whole idea'.

TW was amused that 'the friend was taking the girl out'.

Of the eight Ss who experienced no amusement or laughter, RM was 'puzzled' and SK 'disappointed', but in these as well as the other six Ss there was rapid assimilation in the light of their experience in relation to the previous card so that none of them experienced a negative self-feeling or felt disturbed in relation to the fact that no joke appeared.

The quantitative data show no significant correlation between surprise and laughter[1] or between surprise and amusement.[2]

A comparison of the amusement, surprise and laughter values of the different cards indicates that those cards which have high amusement values do not always have high surprise values and vice versa. A comparison of the amusement values with laughter values is also interesting. Amusement has greater values than laughter—sometimes considerably greater—in those cards which contained a joke, while in Card VII it has a lower value than laughter and in Card VIII it has a low value which is only slightly greater than that for laughter. This shows that the laughter which occurred in connexion with cards which contained no joke had a different relationship to amusement than laughter which came in connexion with those cards which contained a joke.

The following conclusions emerge from the data supplied by Exp. VI:

Surprise is not always associated with laughter or amusement.

Surprise frequently occurs in relation to a stimulus which in itself possesses 'worthwhileness' for amusement or laughter.

If surprise is accompanied or followed by a negative self-feeling, it tends to be associated with laughter, and in such cases if 'amusement' occurs it has a peculiar quality different from that of the emotion which is usually represented by that term.

If surprise is followed by curiosity, disappointment or puzzlement or if there is rapid assimilation of the stimulus following surprise and curiosity, surprise may not be associated with laughter or amusement.

[1] $r = 0{\cdot}042$ with P.E. $= 0{\cdot}21$.

[2] $r = 0{\cdot}16$ with P.E. $= 0{\cdot}14$. The figures are obtained from 'Total values' given in the last column in Table XI. In view of the inadequate data and the possible sources of error, these results must be treated with the greatest reserve.

The fact that amusement and laughter can occur in the absence of surprise shows that at least the original 'worthwhileness' for laughter is not provided by surprise. That some Ss were amused and laughed at some of the jokes which they had seen before confirms this conclusion. But in these Ss the degree of amusement and laughter was lessened because they were familiar with the jokes. This may be taken perhaps to indicate that amusement is one of those emotions which are increased in their intensity by surprise.

Experiment VII. 'Introspections'

Of the twenty-nine cases of surprise in Exp. VII there were only five in which amusement or laughter was reported.

PP was amused at a mistake of a child of nine who thought a book-maker was someone who dealt in books. The amusement was caused therefore by something in the nature of the situation itself.

DM, while sitting in a library, thought he heard someone 'spit aloud' and after he had looked around and listened for a short time there was 'a half smile of wonder' with the question 'did it all happen?' Amusement followed the realization 'I must have been a fool to have thought such things'. In another experience he was surprised at the spelling of a word and he laughed slightly and 'explained to my friends my error'.

MH, when her motor tension had relaxed (after her experience with the door-knob which came off) 'laughed and called out a little uncontrollably, "Good Lord, what a shock!"' With regard to another experience (in relation to a child's 'grunting, jerking tic'), S says: 'I laughed at myself.' She experienced shame, self-consciousness, a feeling of being abashed, and amusement, following her initial surprise and fear.

In one case (PP), therefore, the situation was amusing in itself and the amusement was not caused by surprise, although the latter may have affected the degree of the amusement. In the other four cases it seems that a negative self-feeling was present.

In all other cases surprise was followed by various emotions[1] and laughter or amusement was not reported in relation to any of the experiences.

These data, besides confirming the conclusion that surprise is not always associated with laughter or amusement, show that where

[1] Mentioned in Chapter VI, pp. 75 sqq.

other emotions accompany or follow surprise laughter usually does not occur except as a later reaction connected with a negative self-feeling.

Experiment V. 'Expectation'

Nine out of ten Ss experienced surprise in this experiment. Four of these (KT, BC, TH and MG) looked at E with an expression of puzzlement or wonder immediately E gave the stimulus, while one S (SL) blinked. There was a delayed smile or laughter in these Ss. BP, who looked puzzled at first, experienced a 'tendency to laugh' later, which he ascribed to 'relief from strain'. These Ss (except BP) reported amusement.

Of the remaining three Ss, PL looked alert but reported no emotion following surprise. DL looked steadily at E with a puzzled expression. He says: 'Felt emotionally charged...idea of being left suspended. Thought I had said something wrong.' GB looked bewildered. He interpreted the stimulus as expressing 'I have got it' on the part of E. There was 'vague wondering as to what I ought to do'.

The results of this experiment further confirm the conclusion that surprise is not always associated with laughter or amusement since three of the nine Ss did not respond with either of these reactions.

It is difficult to say what led to the delayed smile or laughter in the other six Ss. The fact that the reaction was a delayed one and that it followed puzzlement in five Ss and slight fear in one (SL), may indicate that something like a negative self-feeling was generated. This seems to be the case at least in BP. Or perhaps it may be that after the first shock of surprise, the snapping of fingers in a meaningless way may have appeared to S as a stimulus provocative of laughter or amusement.

Experiment III. 'Verbal Addition'

In this experiment nineteen out of twenty-three Ss reported surprise for the first surprise stimulus and ten for the second. No amusement was reported.

Since E did not observe Ss, as he was himself engaged in recording reactions, the possibility that some laughter without amusement may have occurred should not be altogether overlooked. Yet, even making allowance for this possibility, it would not be erroneous to suppose that in many cases surprise was not followed by laughter.

Some of the Ss reported feelings similar or related to negative

self-feeling. (E.g. BL, 'Hesitation. A feeling of diffidence.' GR, 'Threw me out of the set I was in.')

In these cases it seems that a feeling, similar or related to negative self-feeling, following on surprise failed to cause laughter because S was engaged in an activity which required a marked degree of conscious conation. The surprise increased the tension (as reported by some Ss), and perhaps because of that failed to lead to laughter. The attitude of the subject seems therefore important in determining whether a stimulus which causes surprise and a feeling akin to negative self-feeling is to cause laughter or not.

In Exps. I and IV, as in Exp. III, no special observations were made and the present problem was not borne in mind. The results therefore must be regarded as of minor importance. As they are, however, they substantiate the conclusion that surprise and amusement are not always associated. In Exp. I, where all Ss were surprised by the first animal and not by other animals, some Ss reported no amusement, while some reported amusement for more than one, and sometimes for all the animals. In Exp. IV there were thirty cases of surprise without amusement and twenty of amusement without surprise.

To sum up the conclusions derived from these investigations:

Surprise is not always associated with laughter or amusement.

Surprise frequently occurs in relation to a stimulus which in itself possesses 'worthwhileness' for amusement or laughter.

If surprise is accompanied or followed by a negative self-feeling, it tends to be associated with laughter, and in such cases if 'amusement' occurs it has a peculiar quality of its own different from that of the emotion which is usually represented by that term. There are indications, however, that even when surprise is associated with a negative self-feeling it may not lead to laughter if the subject is in a condition of excitement or tension.

If surprise comes with or is followed by other emotions, laughter usually does not occur except as a later reaction when it is connected with a negative self-feeling.

To hazard an explanation for the fact that surprise is frequently found in association with laughter, it may be said that it is because of the similarity between the subjective conditions correlated with these experiences. Surprise leads to a state in which for the moment nothing *can be* done; in laughter the subjective state is such that nothing *need be* or *could be* done. In surprise a momentary *status quo* is maintained in the relationship of the subject to his environment.

'Laughter expresses, maintains, and communicates a mood in which there is no need felt for the organism to make any further adjustment to its environment beyond the one at the moment existing.'[1]

A surprising stimulus tends to lead to a momentary arrest, to a momentary maintenance of the *status quo*. But whether the stimulus will lead to laughter or not will depend upon the meaning in which it is cognized after the first shock of surprise. The stimulus may turn out to be one which demands vigorous readjustment of the self. It may then elicit strong emotions. Or it may be at once assimilated and consequently cease to be a stimulus. Or it may turn out to be one which continues to stimulate but is cognized as either undeserving of a reaction or of such a nature that it is not possible for the subject to effect a change in relation to it. A stimulus falling under this last category may be either subliminal, in the emotional sphere, in which case the stimulation will not be deemed adequate to necessitate any change in the relationship between the individual and the stimulus; or it may generate a conflict which forces the individual to remain at a standstill, as it were, in relation to the stimulus; or, after its first cognition which arouses a certain impulse (e.g. of escape) the stimulus is recognized as something undeserving of a reaction;[2] finally, the stimulus may be 'a pleasant situation which does not tend to stimulate any bodily reaction'.[3]

It is in the cases where the stimulus is either undeserving of a readjustment of the self in relation to it or where it is such that a readjustment is not possible, or where the stimulus is in itself 'laugh-worthy' that surprise is likely to be associated with laughter.

Further, in an explanation of the relationship between surprise and laughter the role of simulation seems to be of particular importance especially in view of the communicative function of laughter (emphasized by Piddington[4]). Just as one simulates a threatening attitude to convey to others that one is angry when one is really not angry, so also one may smile or laugh to convey to others that one is in a state of well-being or well-adjustedness, when one is really a little disturbed. Since to be well-adjusted or at least to be undisturbed

[1] Piddington, R., *The Psychology of Laughter*, pp. 85 sq.

[2] Cyril Burt, in an unpublished paper, has regarded laughter as an outlet for energy connected with all emotions which are deemed to be superfluous (and not merely primitive sympathy as postulated by McDougall), while Krishna Menon (*A Theory of Laughter*) has, from a similar view-point, advocated the 'Demobilization' theory of laughter, regarding laughter as an outlet for demobilized instinctual energy.

[3] Piddington, *op. cit.* p. 78.

[4] *Op. cit.* pp. 76 sqq.

(or not to be upset) is one of the accepted social values, it is probable that when an individual is thrown off his balance by surprise (or by other emotions) he should simulate laughter to assure others (and perhaps his own super-ego) that he is well-poised. It seems that in the cases of laughter where negative self-feeling is an important element, the laughter is of this nature. Hence its different quality as compared with the laughter of amusement.

CONCLUSION

The experimental investigations have yielded the following conclusions:

Surprise tends to arrest the motor activity in which the subject is engaged at the moment of surprise. There is also some indication that thought processes as well as involuntary activities, involved in respiration and in the functioning of the heart, might be momentarily checked under surprise.

There is some evidence that the surprising stimulus tends to become focal at the expense of the existing processes, whether cognitive, emotional or conative.

These conclusions substantiate the observations of a large number of psychologists regarding the inhibitory effects of surprise and regarding the relationship of surprise to attention.

The view that surprise tends to enhance the intensity of the emotions which blend with it or immediately follow it receives experimental corroboration.

There are also indications that under surprise a stimulus which has normally no emotional value tends to acquire such value.

The two foregoing tendencies may be grouped together and it may be said that under surprise the emotional value of a stimulus is enhanced.

Surprise was observed to mix easily with other emotions and the brevity of its duration mentioned by some psychologists was also confirmed.

Some clarification of the problem of the relationship of surprise to expectation was achieved. The conclusions reached militate against the view that the presence of an expectation is indispensable before surprise can occur. They tend to favour a broader and more comprehensive definition of the stimulus of surprise than any so far postulated.

It is suggested that surprise tends to occur when an expectation (conscious or non-conscious) is frustrated or when the stimulus conflicts with or is incompatible with previous knowledge, belief or experience.

Surprise is not always associated with laughter or amusement, although it frequently occurs in relation to a stimulus which possesses 'worthwhileness' for amusement or laughter.

If surprise comes with or is followed by other emotions, laughter usually does not occur except as a later reaction when it is connected with a negative self-feeling or a feeling of inferiority.

The results show that surprise, in and of itself, is not a cause of laughter.

The knowledge regarding the conditions under which laughter is likely to be associated with surprise is advanced to a certain extent. The observation of the association of a negative self-feeling with surprise as conducive to laughter seems to be of special importance.

The explanation is offered that the reason for the close association of surprise with laughter is to be found in the similarity in the subjective conditions correlated with these experiences.

Amusement appears to be one of those emotions which are enhanced in their intensity by surprise.

The view that the psycho-galvanic response is related—perhaps particularly related—to experiences of the nature of surprise is substantiated on the basis of an experiment which was so devised as to exclude the arousal of sensory elements, as far as possible.

A speculative suggestion is made that the tendency to the arrest of motor activity and the heightening of consciousness in relation to the surprising stimulus are two aspects of the same process, viz. that of involuntary attention, and that surprise is the affective aspect of that process. If this is so, the main objection advanced against the inclusion of surprise among the emotional tendencies—the objection that it has no conative impulse—will be removed. Surprise will then be *the* primary emotion—the affective aspect of the instinct of attention—connected with the unspecific 'worthwhileness' of an object or situation towards which an orientation, a 'directedness', must be achieved before its specific meaning is cognized.

Such a view would explain a large number of facts connected with surprise. The tendencies of surprise postulated by Shand are explicable on this view. If the arousal of attention is the biological purpose of surprise it is easy to see that surprise should make us attend to its stimulus and that it should survive 'in diminishing intensity in the act of attention that follows it', in the same way that fear would cause us to undertake activities connected with escape and would diminish in its intensity as the impulse of escape is being fulfilled.

The tendencies of surprise to diminish 'the efficiency of the emotion excited with it', and to 'arrest and exclude from consciousness the impulse excited with it by the particular situation', can be explained

on the ground of a conflict of conations. Since the end of surprise would be merely to make the surprising stimulus focal, involving a maintenance of the *status quo*[1] in relation to the object, it is clear that this conation should conflict with the conations attached to other emotions which demand a change of a specific type in relation to the stimulus, and should produce an adverse effect on their efficacy.

Since the surprising event becomes focal in consciousness, demanding a convergence of mental energy towards itself, it can be seen why it 'tends to free the mind of what before occupied it'.

On the basis of the foregoing tendency Shand has regarded surprise as a 'frequent cause of forgetfulness'. If surprise has this detrimental effect on the memory-value of the preceding experience, it is probably due to two causes—insufficient cognition owing to the direction of the attention to the surprising event, and retroactive inhibition.

The tendency of surprise to enhance the intensity of the emotions associated with it, to enhance the emotional value of a stimulus, and the role of surprise in pathogenesis can also be explained in the light of our hypothesis.

It may be said that preparedness for a stimulus implies the operation of some conation, and therefore of some interest, of a specific nature in relation to the stimulus. The less one is prepared for a stimulus, the less specific its 'worthwhileness' is likely to be when the stimulus arrives, so that in a state of lack of preparation the initial 'worthwhileness' of the stimulus is likely to be very unspecific. The state of unpreparedness which is characteristic of surprise is therefore conducive to the perception of a stimulus as merely unspecifically 'worthwhile'. But this condition of unpreparedness, which is favourable for the occurrence of surprise, is also one in which, even after the cognition of the meaning of the stimulus, the appropriate impulse fails to find its expression, at least for a time, thus leading to the generation of strong emotion. The conditions which are favourable for the occurrence of surprise are, therefore, also favourable for the occurrence of high degrees of emotion. Probably a further baulking of the impulse aroused by the stimulus occurs owing to the tendency of surprise to maintain the *status quo* and thus heightens emotion.

It seems that surprise is frequently connected with pathogenesis

[1] It is submitted that the mental process implied in this *active immobility* (if we may use the phrase) which maintains the *status quo*, is as much a conation as that which strives towards a change in relation to the stimulus.

because it tends to heighten emotions and, temporarily at least, to baulk impulses.

The association of surprise with conditions of unpreparedness and the tendency of that emotion to baulk impulses would also explain why it is that emotions commence with surprise.

Since a dim, indeterminate 'awareness' is probably the first experience in ontogeny, it is not to be wondered at that the first emotion may be of the nature of surprise.

If we directed our speculations to the misty past, we may find why surprise appears very early in the evolutionary scale. At the dawn of life, in the first unicellular organism which had just emerged from lifelessness, perhaps the slightest change in the environment led to complete immobility—a relapse into lifelessness. Perhaps in that first reaction to change the sole 'experience' of the organism consisted of an 'awareness' of change, to which cessation of its own activity was the response. Later on, perhaps, the organism learnt to recommence its activity in the face of change. Cessation of its own activity in the interests of a reorientation of the organism, followed by a readjustment, in response to a change in its environment, was perhaps one of the earliest characteristics of life. That primary form of response probably persists all through the evolutionary scale, however differentiated the forms of adjustment, and however brief the initial period of cessation of activity and reorientation may have become.

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